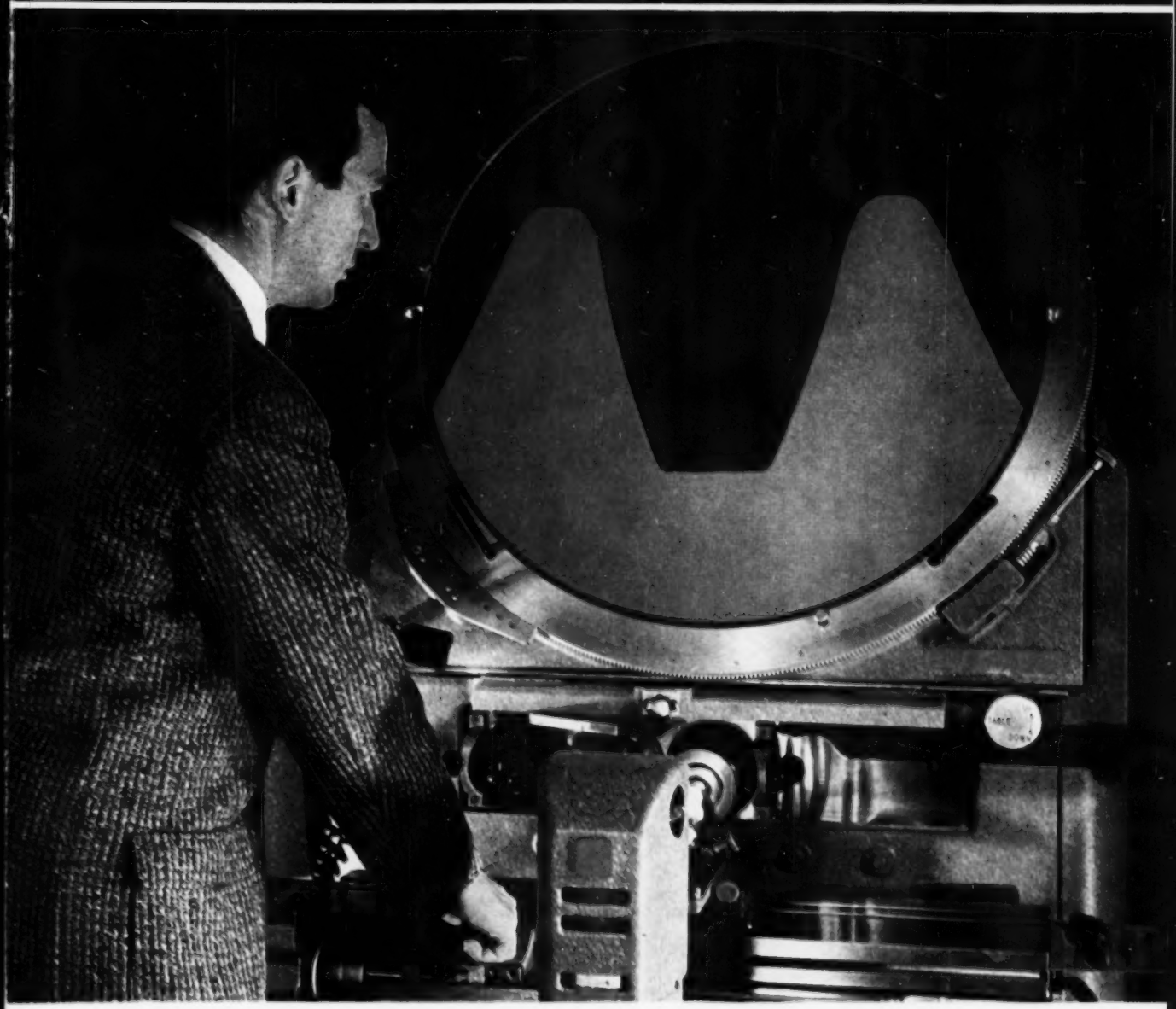
American Machinist

JUNE 1, 1959 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Tubing . . .
How to choose and use it

A Special Report, page 125



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- **Welding breakthrough eases tantalum problems,** page 109
- **Computer synthesis can cut tooling lead time,** page 116

Award-winning Model 090 Centri-Matic

GRINDS INNER RACES THIS SIZE

.040 I.D.

NEW HEALD DEVELOPMENT awarded
Certificate of Excellence in
1958 MINIATURIZATION AWARD
for unique, systems-engineered design

THIS AWARD, the first ever made to a machine tool manufacturer, cited the Model 090 for the following contributions to miniaturization.

"The Heald Model 090 Centerless Internal Grinding Machine is considered to be a radically new development, system-engineered specifically for improved production of miniature ball bearings. Whereas previous equipment had been modified to adapt it to miniature work, the Model 090 was completely designed for this purpose alone, with all components working at optimum efficiency. With this machine, inner races as small as .040" I.D. can be ground to .00015" size tolerance and 5 microinch finish in a fully automated 15-second cycle. Major advances in design include shoe-type centerless workholding with rotation from both front and rear faces — specially-designed super-speed wheelheads — hydrostatic anti-friction feeding cross slide with ultra-sensitive electronic control — and sensitized method for automatically maintaining precise wheel-to-diamond relationship and compensating for drift."

Whether you grind miniature parts or not, this development is a significant example of Heald's ability to solve tough precision-finishing problems. Your Heald engineer will welcome *your* problems, too.

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TURN PAGE FOR METALWORKING REPORT →

METALWORKING REPORT

SIGNIFICANT CURRENT DEVELOPMENTS IN TOOLING AND PRODUCTION PROCESSES

CUTTING

Contouring Application

A reverse twist on special machines for the missile age is found in a lathe, originally designed for missile work, being applied to solve an earthbound problem. The Yoder Co, Cleveland, is using a Sidney Space-Master equipped with a fluid tracer to automatically contour rolls from 22 to 50 in. in dia.

With carbide button inserts (Grade 370), about $^{3}/_{4}$ in. is removed from the OD of the rolls at cutting speeds of 120 sfpm for roughing and 160 sfpm for finishing. The work is a high-carbon high-chrome steel.

Centerless Grinding

What would you do if management asked you to improve quality by 250%? We are talking about through-feed grinding to 0.0001 in. over long periods, not to 0.00025.

According to a consulting engineer, who has spent a number of years in mass-production plants on development of methods, you have to think about three matters: (1) suitable machines, (2) controls that will lock-in the dimensional output of these machines to desired accuracy and (3) education of operating personnel.

To get at the answers you must analyze the fixed errors: (1) machine scatter, (2) discrepancies in set-up masters, (3) discrepancies in gaging equipment, and (4) discrepancy in the size-correcting mechanism. When these fixed errors are known, and reduced to manageable limits, there is more leeway to assure close tolerance grinding over long periods. For details see page 98.

FORMING

Progressive Dies Also Assemble

Labor costs on many cheap, mass-produced items are excessive to engineers who are "automation" conscious. One often sees from 10 to 30 women assembling the components of a two- or three-piece assembly that should be done automatically at rates of 60-75 pc per min.

Many of these assemblies consist of stamped parts and purchased pieces. An effective manufacturing method is to make the stamped items in progressive dies and assemble them into the hopper-fed manufactured parts. The entire job is done on a single press.

Current tooling makes assemblies from 10 to 20 times as fast as hand methods at August W Holmberg, Inc, Flushing, NY.

FORMING

Ryan Adopts Explosive Forming

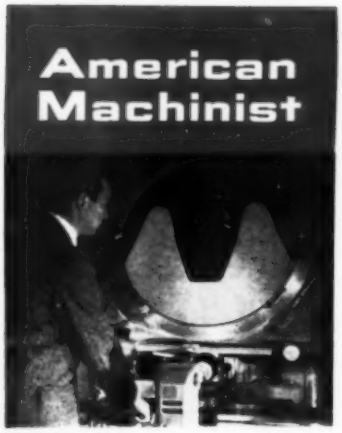
A complete high-energy forming facility is being installed at its San Diego plant by Ryan Aeronautical Co. Hemispheres, corrugations, deep draws and many complex shapes have been produced in stainless steels, Inconel, titanium, brass, copper, aluminum, and nickel- and cobalt-base super alloys.

Jobs are being produced in a few minutes instead of hours. The technique requires only an inexpensive die made of lead-zinc alloy or plastic, rather than steel. The metal part is placed in the die with a few cents worth of explosive, and the assembly is lowered into a water pit. When detonated, the explosion forces the water against the part, and the latter assumes the shape of the die—at speeds of 200 to 500 ft per sec. Water blows out of the pit like a geyser. The resultant formed part has almost no springback.

Several explosives being evaluated, including TNT, nitroglycerine, and 30% ammonia gel. These explosives produce pressures of 490,000 to 1,200,000 psi.

CAUTION

These pages are not a synopis of this issue of American Machinist. Major articles are described briefly in the Contents page. Because the Trends pages are classified by subject, they are not described anywhere else. Most of the developments in this department are so new that further information is not yet available —when it is, you will find a page reference to the article.



COVER:

Mercury-vapor-arc lamp illuminates comparator screen with five times light intensity of best available filament source. Gear shown magnified 270 times is a straight spur having a base circle diameter of 1.1159 in., 57 teeth, a diametral pitch of 48 and a 20 degree pressure angle. Lamp, developed by Jones & Lamson Machine Co, is described on page 145.

HEAT TREATING

Muffle-less Atmosphere Furnace

Specially designed for high-production bright annealing, brazing and atmosphere quenching, this furnace uses a special high-purity alumina brick in place of costly, oft-replaced metal muffles. It is believed to be the largest belt-conveyor, hump-type, hydrogen-atmosphere furnace ever manufactured without metal muffles. The furnace is designed for commercial purposes.

Hi-Temp Inc, Northlake, Ill, uses this 71-ft long, General Electric-built, electric furnace to bright harden steel dies, to bright anneal 18-8 stainless-steel kitchen sinks after the initial draw, and to braze aircraft and missile parts made of 416, 420 and 440 stainless while holding tolerances of 0.0005 in. Many electronic components, made of a combination of 18-8 and carbon steel, can be bright-copper brazed without flux.

The alumina brick maintains a dew-point of –60 F and produces bright, oxide-free results. The furnace is rated at 2100 F at 195 kw.

INSPECTION

Gage Checks Casting Thickness

Wall thickness of cast cylinders can be checked magnetically, but accuracy may be influenced by varying magnetic properties of metals under test. That is why the General Motors Process Development Staff designed an ultrasonic gage.

The tester can be adapted to measuring the thickness of straight or curved surfaces of cast iron, steel, aluminum, magnesium, brass, lead, glass and most solid plastics, even though only one side of the material is accessible.

GM's instrument is housed in a portable cabinet (27 x 14½ x 17 in.) which can be set up in any shop or assembly plant. A typical thickness range for checking would be 0.075 to 0.300 in. in cast iron within 2% of full-scale reading. The accuracy can be in thousandths, if required.

To use the device, a crystal probe is vibrated against the cylinder's internal wall at up to 4,000,000 cycles per sec. until at some frequency the surface vibrates in harmony with the crystal. At this point, the oscilloscope shows a single vertical step, instead of two or more "pips." A warning light may be rigged to show if wall thickness is substandard, or other devices can be applied to mark or segregate parts automatically.

Eddy-Current Analysis

Introduced in a primitive way during World War II, eddy-current nondestructive testing has developed rapidly in recent years. According to Dr Glenn O McClurg, Div of Research, Magnaflux Corp, Chicago, the technique shows great promise.

Eddy currents are created in the metal part by a varying field induced by an alternating current of suitable frequency in a coil adjacent to the part. These eddy currents vary with the characteristics of the metals; they react on the exciting coil (or upon a secondary coil used as a sensing device) and affect its impedance.

Variations in the eddy currents may be caused by: electrical conductivity, magnetic permeability, dielectric susceptibility, size and shape of test object, frequency of field variations, and degree of coupling between exciting coil, part, and pick-up coil.

THE OUTLOOK

Output is slowly riding to an even higher level. Though some setback may occur as result of a steel strike, indications are that metalworking production will break all records in fourth quarter. Consumer goods are up considerably and capital goods are doing better. *See p89.*

WELDING

Pipe Welding Simplified

A new automatic welding rig weighing only 35 lb takes less than one minute of arc time to butt weld 4-in., schedule 40 aluminum pipe. The unit employs the Mig process (consumable-electrode, inert-gas) and is operated by a conventional engine-driven, d-c, power supply rated at 200 amps.

In operation, the unit is fastened to the pipe with a strap clamp. Then a geared mechanism drives the welding gun completely around the pipe at any selected speed from 50 to 250 ipm.

It's versatile, too. The torch itself, with its 2-lb spool of 0.035-in. wire can be removed from the unit for manual welding whenever necessary.

The equipment was developed by Aluminium Ltd, and the company states that production units based on the design will be available in the near future. Several sizes will weld pipe from 2 to 8 in. in dia, with the largest weighing 50 lb.

ASSEMBLY

Soldering Aluminum to Uranium

Zinc, lead, tin and their alloys were studied by scientists at Battelle Memorial Institute, on behalf of the USAEC, to determine the best material for joining aluminum containers to uranium fuel elements. Because no provision was made for removing surface oxides from the metals to be joined, the surfaces were copper plated. Solder was applied as foil, as plating, or as a dip coat between the aluminum and uranium plates before heating.

Technologists report that while all of the solders produced good bonds, those with 70% weight, or more, of zinc proved strongest. Samples soldered with 30 weight % zinc—70 weight % tin provided the best combination of strength and corrosion resistance.

FINISHING

Peening With Glass

Tiny glass beads, electrostatically suspended in a solution, may offer the answer to many of today's peening problems. Called Perfecto-Peen, the process has been developed by Aero-Test Equipment Co Inc, Dallas, Tex, and is showing remarkable results in removing scale, corrosion, dirt, burrs, and tool marks without altering the dimensions of the base metal. It does not nick sharp edges or threads, and does not leave imbedded particles in the surface to cause contamination. Finishes up to 4 mu in. are obtained.

Automatic Painter

Said to be one of the most efficient painting installations in existence, a $600,000 electrostatic finishing system has been installed at Singer Mfg Co, Elizabethport, NJ. Served by electronically scheduled overhead conveyors, the setup can process from 6 to 1500 parts per min, depending on size.

Parts are washed in an automatic washer at 6 fpm, rinsed, rewashed in hot chromic acid solution, then baked at 400 F for 5 min. The Ransburg electrostatic paint system operates at 90,000 v, with the disks rotating at 4500 rpm and reciprocating at 10 strokes per min. Two coats of primer are applied, followed by baking at 325 F for 30 min, sanding, and inspection. Next follow two coats of baked enamel, and two top coats of baked enamel.

During the entire cleaning and finishing cycle, only inspection, filling, touchup, and sanding after priming are performed manually. All other operations are automatic and are scheduled on a master electrical control panel board built by Singer.

Automated Hot-Galvanizing

Pre-threaded, hot-galvanized electrical conduit is the special product of a unique galvanizing machine that has just gone into operation at the new plant of Pittsburgh Standard Conduit Co in Verona, Pa. Controlled by one man in a nearby booth, the automatic machine does the work that six men did on the same job in the company's old plant.

Pre-threading the pipe is a departure from conventional galvanizing

METALWORKING REPORT . . .

practices, where conduit normally is galvanized first and the threads have to be finished in a separate operation. To do the trick, PSC uses wiping rings, superheated steam, compressed air, and a variety of unique handling devices.

For a detailed description of the machine, together with other features in the new plant, see the story beginning on page 104.

MATERIALS HANDLING

Mechanized Job-Shop Handling

Completely mechanized handling in a job shop may sound impossible, but the new Merrimack Valley Works (North Andover, Mass) of the Western Electric Co goes a long way toward reaching this goal. Plant is a massive job shop (1½ million sq ft) that has to handle about 1200 types of transmission equipment, ranging from tiny transistors to 12-ft-long wired equipment bays.

- An electronic computer and a magnetic-memory device establish and maintain a perpetual inventory file, process incoming orders, control manufacturing schedules, issue punched-card selected documents for storeroom use, and issue stock-status reports.
- In the piece-parts shop, a 1000-ft-long overhead chain conveyor is equipped with 13 parasitically driven switching spurs, one terminating at each of the 13 machine areas. Dragline trucks, attached to the overhead conveyor, carry the heavy parts from one machine area to another.

Automated Chip Handling

A large, custom-built chip-handling system, designed to automatically remove chips from under a 60-in. grooving lathe, is now in operation at a Schenectady, NY, plant of General Electric. Two of the plant's lathes are equipped with the system.

In the system, hinged-pan conveyors pass under the lathe, catching the falling chips and automatically conveying them to elevating conveyors. Next the chips are elevated, then dumped into tote boxes for removal to a disposal center.

For a sketch of the system, turn to page 117.

MATERIALS & COMPONENTS

Rectified A-C for Autos

Adding substantially to its present capacity of 5000 silicon rectifiers per day, for automotive ignition systems, Fansteel Metallurgical Corp's (North Chicago, Ill) new plant should be ready by Jan 1960. Plant is being built to meet an expected demand for rectifiers in 1960 and 1961 cars.

Automotive alternator - rectifier electrical systems employ three-phase alternators, or alternating-current generators, in place of the conventional d-c generator. The alternator offers a number of advantages including greater power output and sufficient capacity to charge the battery even when the engine is idling. The entire output of the alternator is converted to d-c through rectifiers. Selenium rectifiers have been used for a number of years in buses, cross-country trucks, taxicabs, police cars, railway cabooses, and many other vehicles equipped with radio telephones. The new silicon rectifier can be built directly into the alternator.

Phenolic, Glass Combined

Glass fibers are drawn through a bath of phenolic resin, then wrapped around a mandrel to form heat-resistant and strong rocket nozzles Glass fibers provide strength; phenolic has high heat-resistant properties. Formed assembly is cured to harden and smooth the surface. Result is high tensile strength, low density, for high strength/weight ratios. Aerojet General is the developing company.

MANUFACTURING CONTROL

TQC and Productivity

As part of its "Total Quality Control" concept for improving productivity, GE made a study to determine what areas its quality-control expenditures included. Study showed that out of every TQC dollar, 62¢ went into failure costs, 28¢ into appraisal costs, and 10¢ into prevention costs. Of the latter cost, 6¢ was spent on maintenance of patterns and tools, only 4¢ on pure prevention. The survey caused GE management to launch a program of more expenditures on pure prevention. For other remarks on productivity, see page 95.

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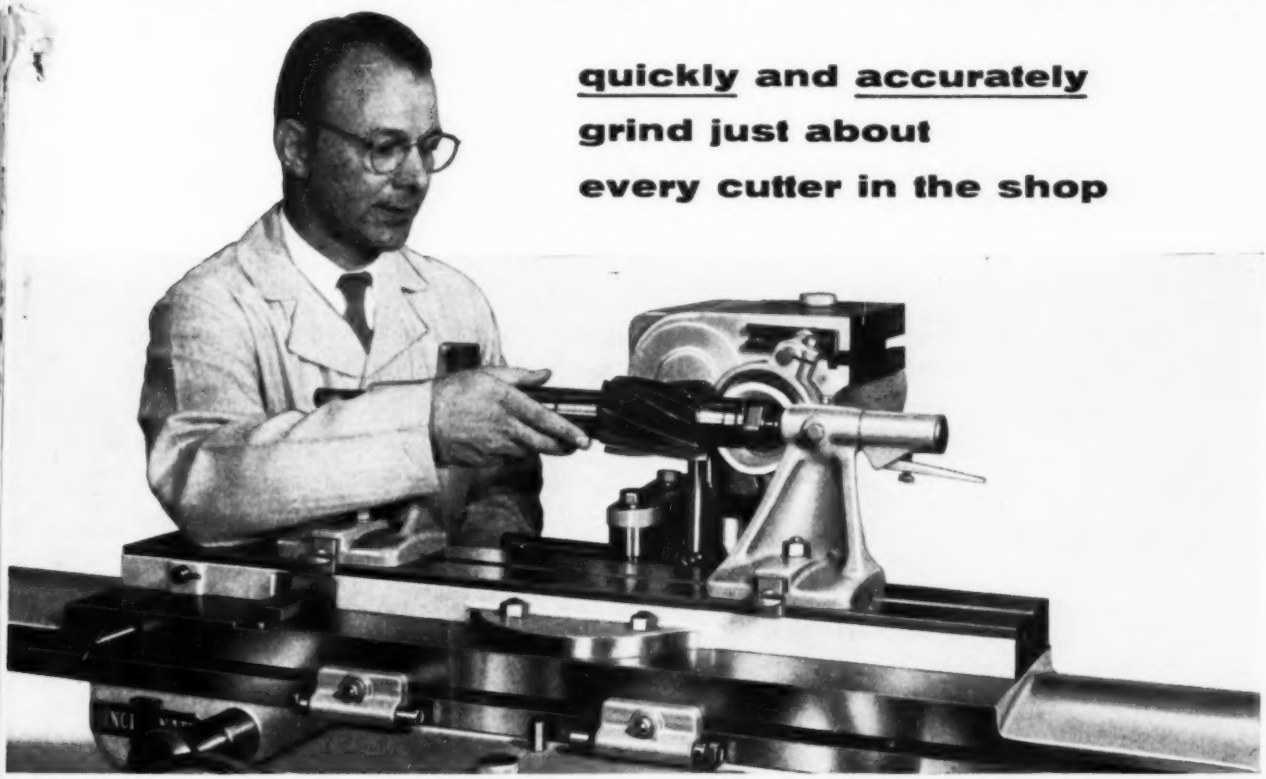
CINCINNATI

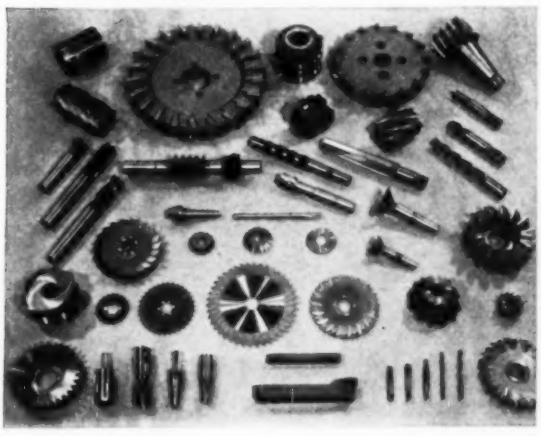
Cincinnati Cutter and Tool Grinders

quickly and accurately grind just about every cutter in the shop



Rear left-hand working position . . . a Cincinnati operating convenience for grinding many types of cutters.

Below: An extremely wide variety of cutting tools are ground quickly and accurately on CINCINNATI Cutter and Tool Grinders.



Today's complex machining operations demand a variety of cutters, and quite often, specific servant machines to grind them. Recognizing this need, Cincinnati offers five versatile Cutter and Tool Grinders which quickly and accurately grind just about every cutter in the shop.

Shops using a preponderance of medium to large cutters do their best work with CINCINNATI No. 2's serving the metal cutting machines. Other shops using a variety of small cutters benefit by having both the No. 1 and No. 2 sizes. And for grinding die sinking cutters and unique shapes, a CINCINNATI Monoset is the star performer. Contour ground form cutters, the type which produce work far superior to that of form relieved cutters, are ground on the CINCINNATI Contour Cutter Grinder. And small accurate die parts and screw machine cutters are ground to advantage on a CINCINNATI Projecto-Form Grinder.

Typical job applications and data are shown on the next two pages. Our Cutter Grinding Specialists will gladly give you more information. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

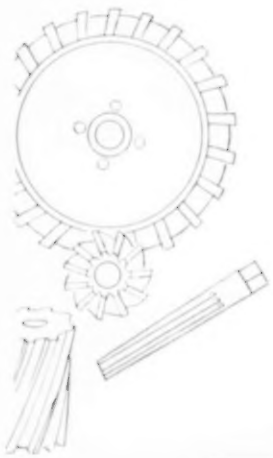
KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI®

MILLING MACHINE DIVISION

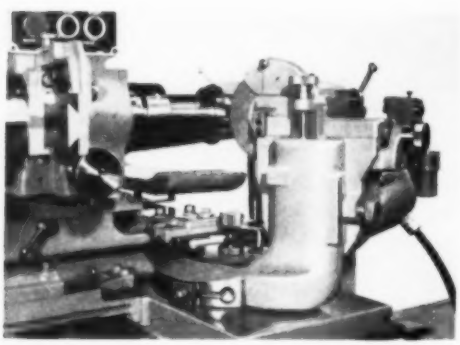
FOR TOP METAL CUTTING

CINCINNATI GIVES YOU A CHOICE OF 5

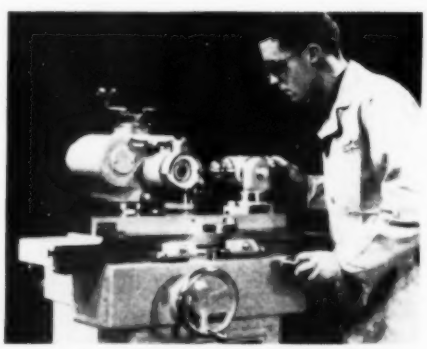


To get the most out of your machine tools, you should operate them *all day, every day* at a consistently high rate. And essential to this high efficiency is a strong secondary line of production, such as CINCINNATI Cutter and Tool Grinders. Here you have a choice of five machines designed to grind just about every cutter in your shop . . . including all types of milling and die sinking cutters, reamers, hobs and taps. CINCINNATIS do the job quickly and accurately, restore cutters to their most effective cutting trim.

For complete information concerning expendable tools, talk to our Cutter Grinder Specialists. Or write for the catalogs mentioned under the illustrations.



CONTOUR offers big savings for shops having a volume of form milling operations. It grinds form milling cutters (illustrated) on the periphery of the teeth to a definite cutting clearance chosen for the work material. Contour ground cutters produce a greatly superior finish at a higher feed rate. Catalog No. M-1918-1.



No. 1—Companion machine to the larger No. 2, perfect for shops using only small- to medium-sized cutters such as the small face mill being ground above. Timesaving features include anti-friction table slide; eccentric wheelhead swivel mounting; reversible motor built into wheelhead; three-way controls. Capacity: 8" swing over table, 15" between centers. Catalog No. M-1852-3.

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES •

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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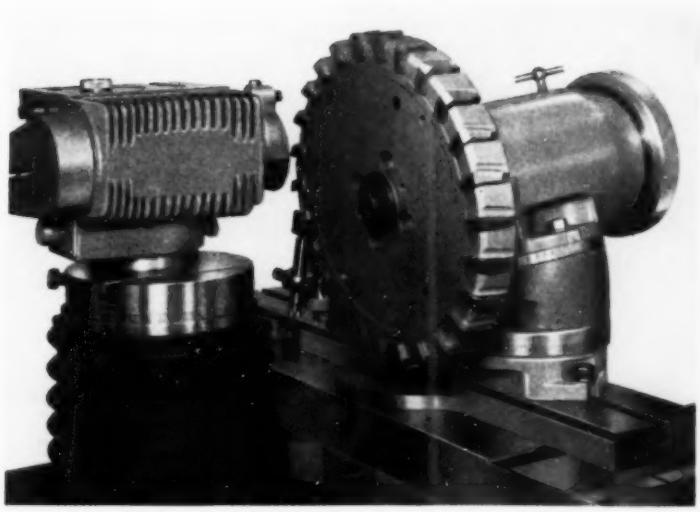
EFFICIENCY. . .

CUTTER AND TOOL GRINDERS

CINCINNATI

MONOSET sharpens, repairs and makes small cutters, including countersinks, those required for die sinking (illustrated), and other unusual shapes. Because of its universal construction, most jobs can be completed in one chucking. Built-in spiral lead mechanism generates infinitely variable helices, right- or left-hand, $1\frac{13}{16}$" min. lead. Catalog No. M-1591-4.



No. 2 with Face Mill Attachment here grinds a heavy 18" diameter face mill. The No. 2 is designed to handle the majority of cutters used in metalworking shops . . . milling cutters, reamers, hobs, taps, planer tools. Other attachments include Radius Grinding; Indexing for Workhead; Dust Exhaust; Spring Chucks and Collets. Capacity: 10" swing over table, 27" between centers. Catalog No. M-1914-4.

PROJECTO-FORM—For grinding small, accurate profile shapes on flat form cutters, lamination die parts and similar components. This machine combines grinding with an optical comparator unit. Work profile is enlarged 20 (or 40) times size on ground glass viewing screen directly in front of operator, as shown in the illustration above. Master drawings are made on Layout Scribing Machine. Catalog No. M-1612-5.

• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

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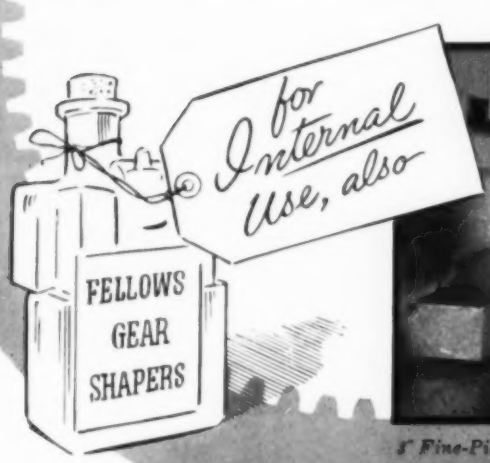
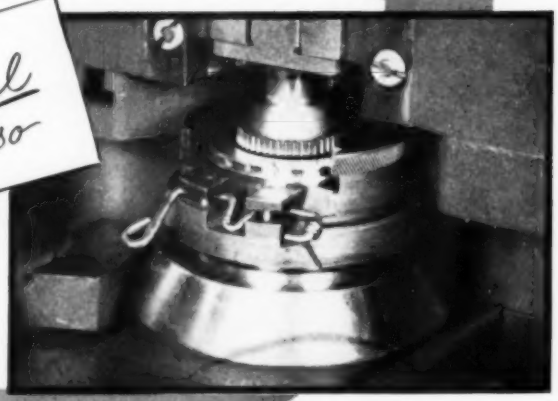
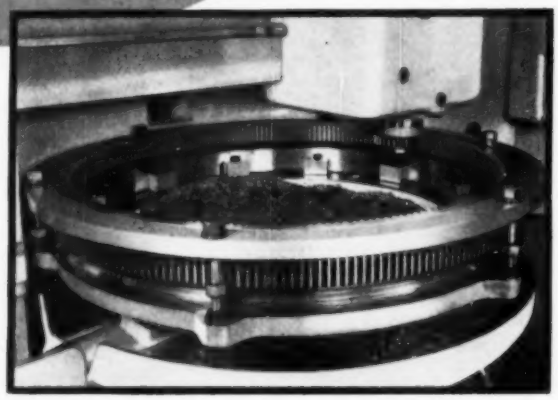
cut INTERNAL Gears



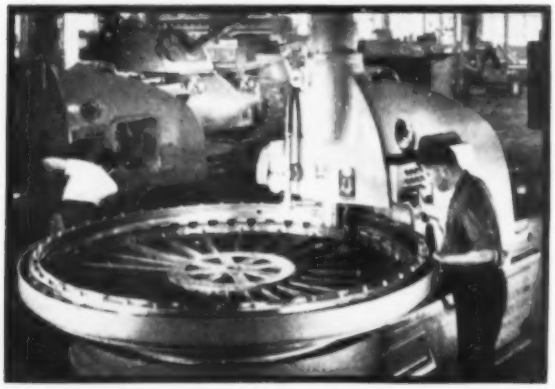


5' Fine-Pitch Gear Shaper cutting internal gear

No. 10 Rotary Gear Shaper cutting internal helical.



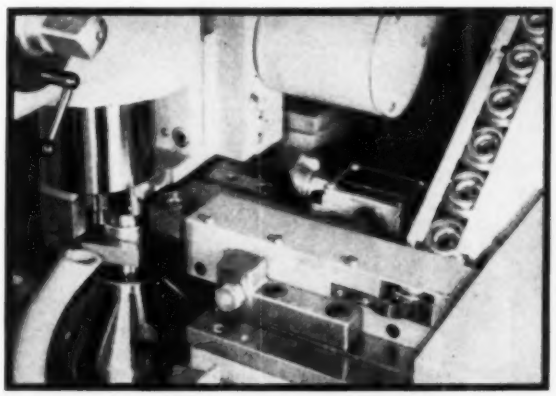
36-Type Gear Shaper with special work-holding fixture.



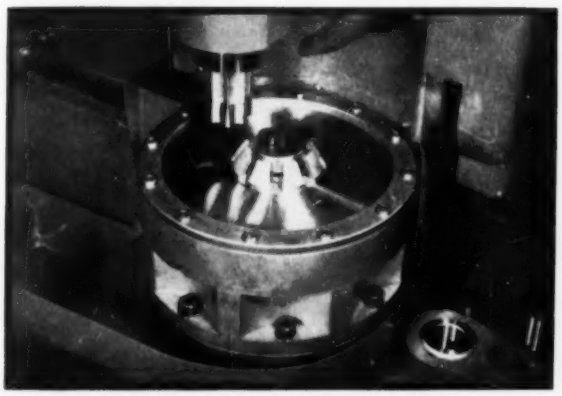
120" Gear Shaper cutting light tank turret gear.

THE
PRECISION
LINE

as EASILY as Externals



4GS Gear Shaper with full-automatic operation.



7A-Type Gear Shaper with fast-action diaphragm chuck.

Not only internal gears, but splines, clutches and an almost unlimited variety of other internal shapes can be produced on versatile Fellows Gear Shapers just as simply, rapidly and economically as external shapes. In many cases, the same Gear Shaper cutter can be used to cut both internal gears and their mating pinions.

Set-ups and change-overs are simple and fast on any Gear Shaper from the 3-Inch Fine-Pitch to the 120-Inch. Rigid construction makes it possible to hold close tolerances at high production rates. On some models, full or semi-automatic operation is available whenever the size and shape of the work and the production requirements make it practical.

Your Fellows Representative can give you full information about the production benefits of Fellows gear shapers, shaving machines, grinding machines, inspection instruments, or cutting tools. Just contact the nearest Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

CIRCLE 175 READER SERVICE CARD

LANROLL attachment

exclusive features

The LANROLL Attachments offer certain features of design that ensure greater accuracy, flexibility and economy not generally found in Thread Rolling Tools. The LANROLL Attachment (capable of producing straight or taper threads) is primarily for application to bar automatics, but may be applied very successfully to the cross slide of a lathe with power feed. Five sizes of the Attachment thread all diameters from #5 to 1¾" (1/16" to 1¼" pipe). For additional detailed information, please request Bulletin G-96.

Threading Machines

Die Heads—Rotary & Stationary

Taps—Collapsible & Solid Adjustable

Centerless Thread Grinding Machines

Thread Rolling Tools

Thread Rolling Machines

B14C

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

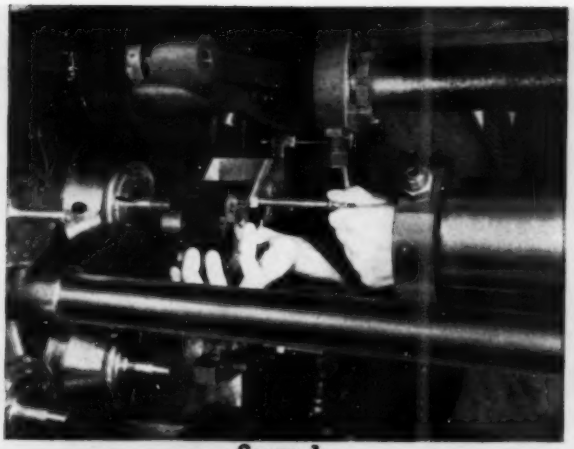


figure 1

1. Disengaging the attachment from the shank for servicing and tooling changes without disturbing the original set-up is made possible by the simplicity of design. The shank maintains attachment set-up position and remains clamped on the tool slide. Removal of the attachment from the shank simply requires that a single retaining screw be released and the shank pin withdrawn. (Figures 1 & 2).

2. Tipping avoids indexing interference on bar automatics having a limited tool slide movement. When necessary, the basic design permits the attachment to radially pivot away from the rolling area on completion of the thread (Figure 2). This also permits: an attachment of heavier construction, minimizing deflections and assuring exact sizing; larger roll diameters for greater rolling efficiency; and more rugged spindles.

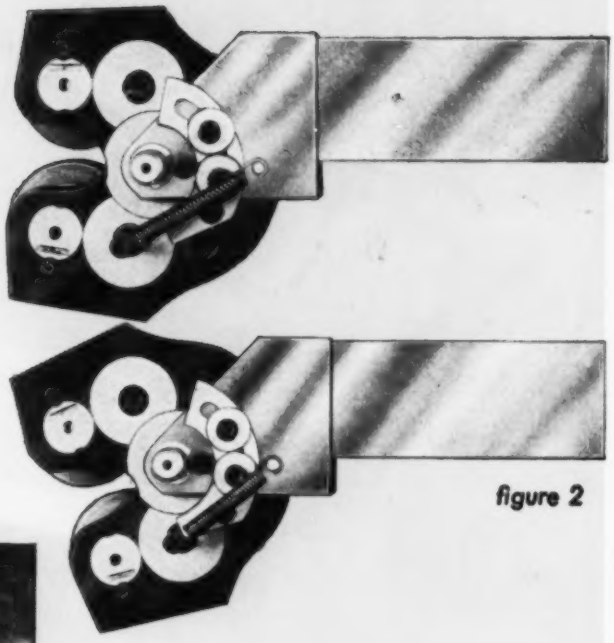
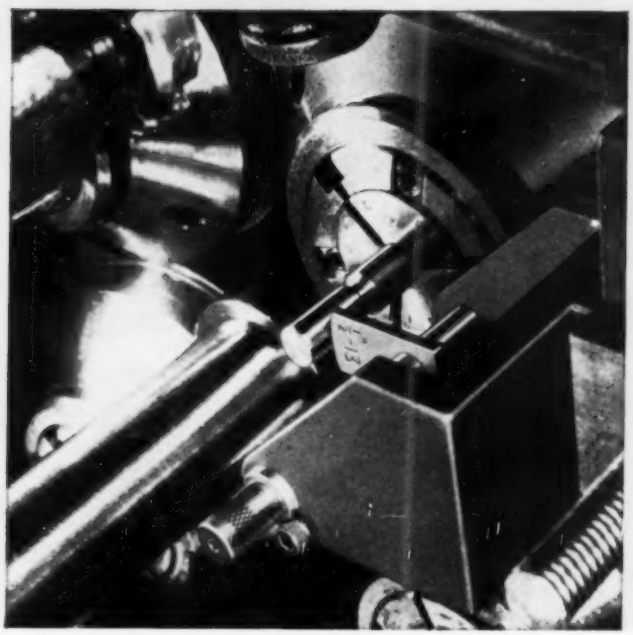


figure 2



3. A Gage quickly determines the precise position where the vertical centerlines of both the rolls and workpiece coincide. After the attachment has been positioned horizontally in relation to the prepared workblank, the setting gage is slipped over the shank pin. The high point of the machine's feed cam is established, and the tool slide is advanced until the gage abutts with the O.D. of the workblank (Figure 3).

figure 3

new

LANDIS microfeed

. . . a fine feed to final size that guarantees precision to "tenths" tolerances on a **production** basis

The mark for close tolerance production grinding

NEW LANDIS MICROFEED

Here is a new cylindrical grinding feed that overcomes all the limitations of conventional feed systems for this class of work.

New Landis R Plunge Grinder with MICROFEED automatically grinding 3 diameters and face of transmission shafts with dependable accuracy.

Cost saving production advantages of Landis MICROFEED

- automatically compensates for wheel wear and machine temperature variations
- eliminates manual re-adjustments of wheel feed due to wheel and machine variables
- eliminates costly rejects and reworking
- easy to set feed reduces set-up time

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

Symbols of Service

to all metal-working industries

The Morse "house emblem" and the NIDA seal are *double warranty* of the best you can get in quality and service.

For Morse-Franchised Distributors are like the tools they sell . . . tested and proven on their jobs . . . men of experience and responsibility who know how to get you top value for every dollar you spend on cutting tools.

So call him in today . . . *your* Morse-Franchised Distributor. You'll find him more and more of a business asset, the longer you do business with him.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

WAREHOUSES IN NEW YORK, CHICAGO, DETROIT, DALLAS, SAN FRANCISCO

A Division of VAN NORMAN INDUSTRIES, INC.

Morse

CUTTING TOOLS

INDUSTRIAL DISTRIBUTORS

SERVING INDUSTRY ECONOMICALLY

THE RIGHT HAND OF PRODUCTION

Here's how the new No. 4 permitted an improved machining method on the "bottom checks"... B-I-F's older machines had hand-operated collet chucks and bar feeds which required a turret station for a stock stop. In addition to the stock stop, six additional turret faces were required for the tooling, but only five stations were open. This meant that a quick change holder had to be placed on one turret face. For each part produced, a manual exchange of tooling had to be made in this one turret station. This was not only a fatiguing operation, but occasionally confused the operator as to which tool was in place, resulting in an occasionally scrapped part.

However, longitudinal feeding accuracy of the No. 4's hydraulic bar feed eliminated the need for a hex turret stock stop and thus opened up one more face on the turret—eliminated the hand exchange of tooling.

CIRCLE 182 READER SERVICE CARD

At B-I-F INDUSTRIES, INC.

Providence, Rhode Island

Modernization with Warner & Swasey No. 4 Turret Lathe saves FOUR minutes per piece on this "Bottom Check"

In this case, the new machine permitted an improved tooling method which combined to reduce first operation machining time from 10 to 6 minutes!

At B-I-F INDUSTRIES a wide variety of jobs are machined in lot sizes varying from 50 to 200 pieces—some special runs require only 3 or 4 pieces. Materials machined cover an equally broad range—from free-machining brass to various grades of stainless, Monel and Hastelloy.

B-I-F made a 31-week study of the new No. 4 versus their older No. 4's. The result showed substantial production increases on all types of machining jobs.

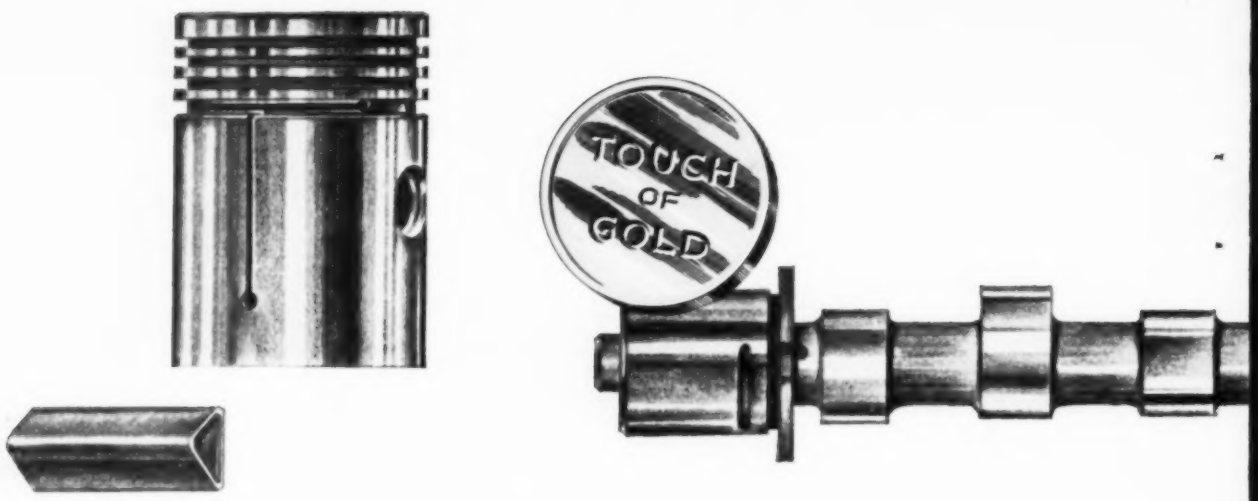
Machine features helping to effect these production time and cost savings include:

- **Handling ease of the machine—each model Warner & Swasey is individually designed for a specific range of work.**
- **Ease and simplicity of speed preselection and engagement—new all-clutch headstock design encourages use of the correct speed for every cut.**
- **Ability of the No. 4 to hold tolerances from .0005 to .001-inch total—helped eliminate subsequent finishing operations.**
- **Vibration-free running of constant mesh gear train headstock—substantially improved cutter life, permitted 32 to 63 micro-inch surface finishes to be easily held.**

Check today with your Warner & Swasey Field Representative and see how these versatile No. 4 Ram Type Turret Lathes can fit into your production picture—increasing production, boosting profits.

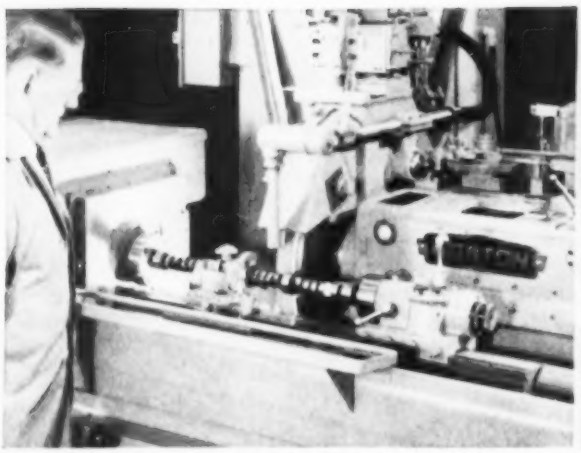
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

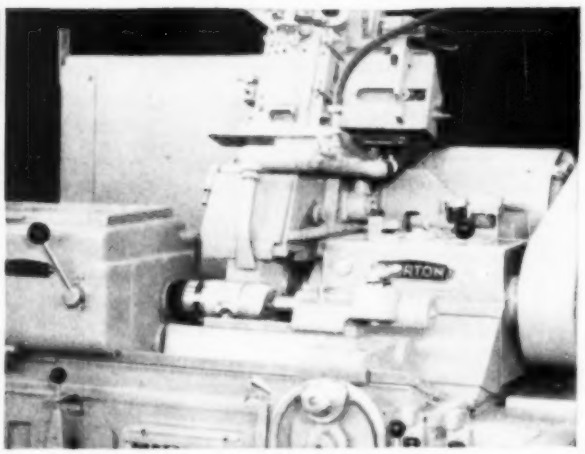


If you grind
special shapes . . . like these

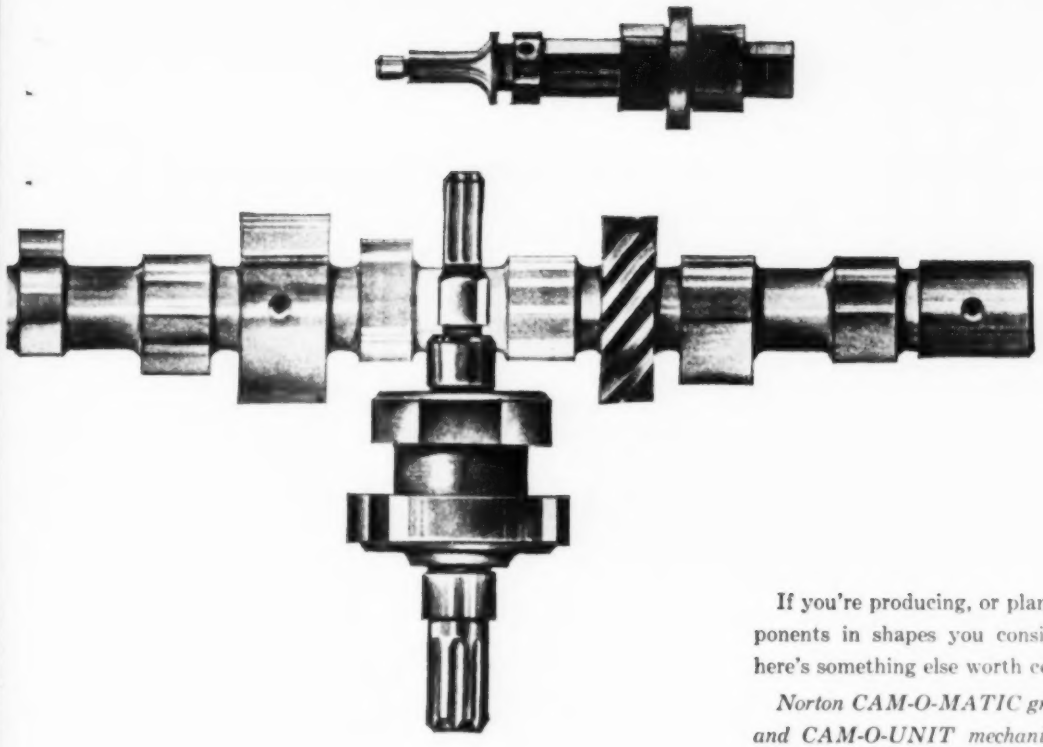
Check the special advantages of Norton grinders . . .



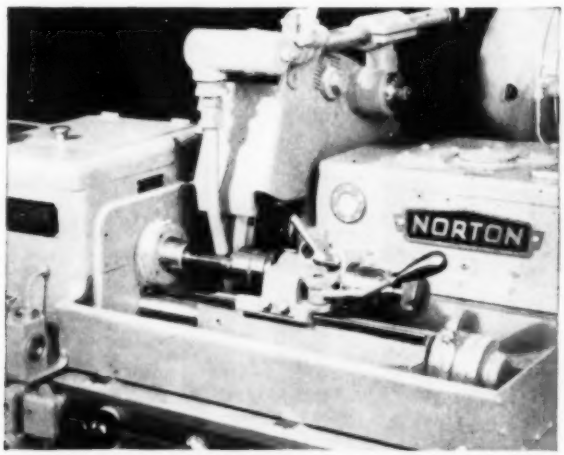
With a Norton No. 3 CAM-O-MATIC® Grinder, you grind all cams and the eccentric on an automotive-type camshaft automatically, in one handling. Automatic wheel truing and a patented device for grinding cam tapers in one or both directions are among the features that improve contour, finish and production rate.



A Norton 6" x 8" Semiautomatic Piston Grinder adds extra speed and economy to your grinding of elliptical pistons. Mechanism arrangements enable you to grind complex ovality into the skirt of a piston, as shown, or to produce standard ovality or different amounts of relief over a wide range.



. . like these



Norton CAM-O-UNIT* Mechanisms, made in varying work capacities, are particularly valuable for extending the proved advantages of Norton CTU cylindrical grinders to the grinding of cams, elliptical pistons and many other forms. The CAM-O-UNIT mechanism shown is attached to a 6" CTU to grind the three faces of a carbide tool bit.

If you're producing, or planning to produce, components in shapes you consider difficult to grind, here's something else worth considering.

Norton CAM-O-MATIC grinders, piston grinders and CAM-O-UNIT mechanisms are engineered to handle a wide range of cam and shape grinding . . . including endless variations of square, triangular, oval and many-sided forms . . . and to provide the exact forms and tolerances you need with fast, trouble-free performance that will lower your operating costs.

Shapes you can produce on this special grinding equipment include not only arcs but curves and tangent flats in combination. Your Norton Man, a trained grinding engineer, will be glad to give you expert help in selecting and operating grinding equipment that will bring you top-quality, low-cost results on the toughest jobs. NORTON Company, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Limited, Toronto 5.

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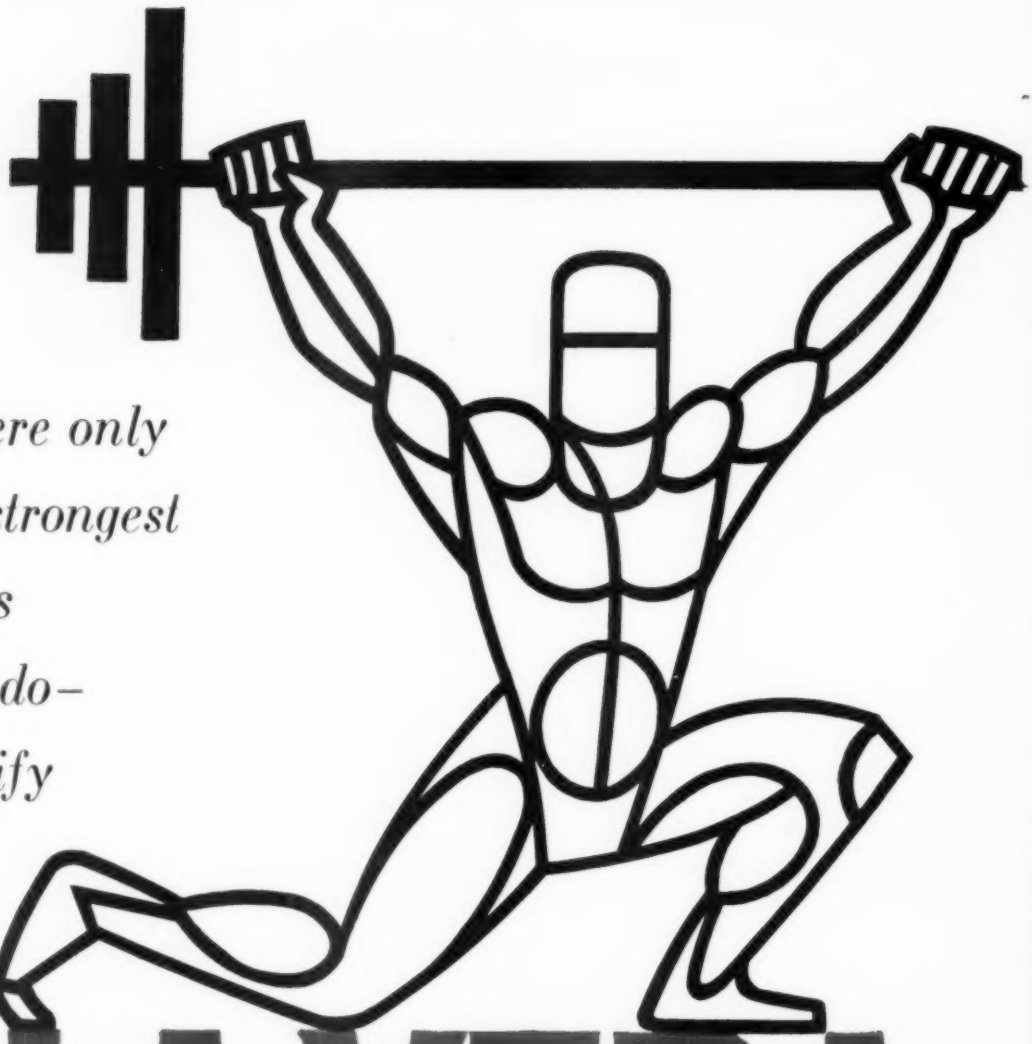
NORTON

GRINDERS and LAPPERS

Making better products
...to make your products better

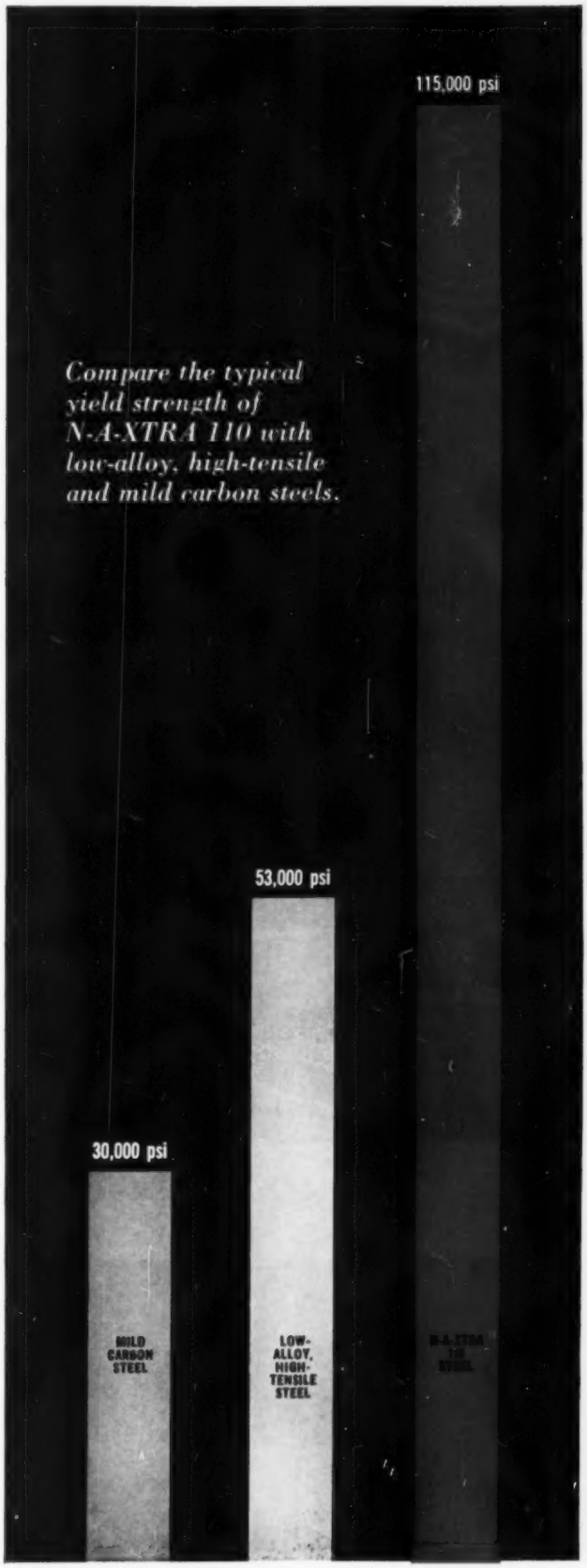
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEAN-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes



Where only the strongest steels will do– specify

N-A-XTRA

BEST LOW-ALLOY EXTRA-STRENGTH STEEL YOU CAN BUY


115,000 psi
Compare the typical yield strength of N-A-XTRA 110 with low-alloy, high-tensile and mild carbon steels.
53,000 psi
30,000 psi
MILD CARBON STEEL
LOW-ALLOY, HIGH-TENSILE STEEL

Now available, N-A-XTRA HIGH-STRENGTH is a low-alloy heat-treated steel, fully quenched and tempered. The minimum yield strength range of N-A-XTRA steel is from 80,000 to 110,000 psi.

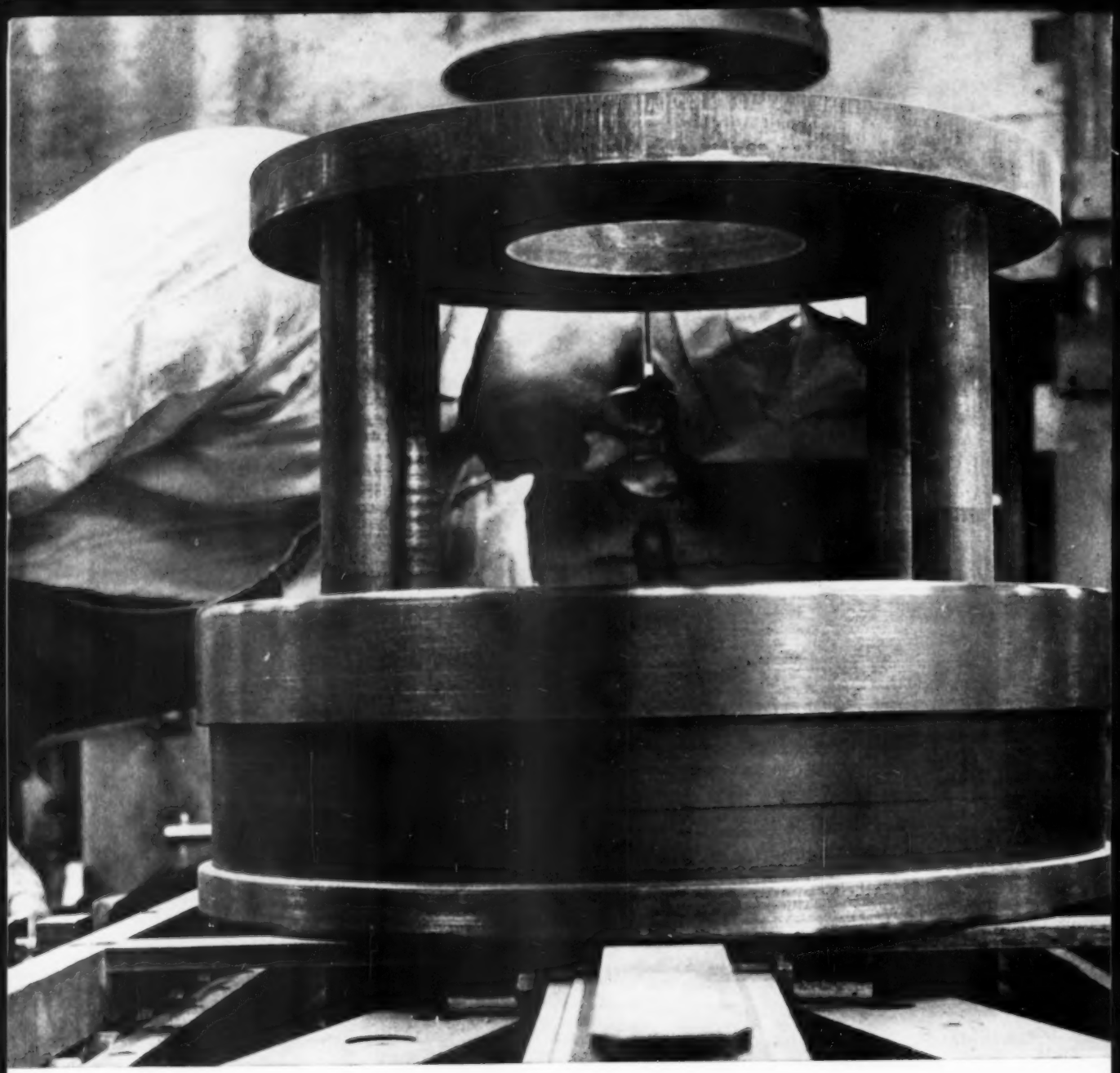
The great strength of N-A-XTRA (nearly three times that of mild carbon steels) gives designers the opportunity to eliminate costly dead weight from your products.

N-A-XTRA is tough at normal and subnormal temperatures. It can be readily cold formed into difficult shapes. And it welds beautifully by any process—with no underbead cracking. For a job where only the strongest of steels will do . . . specify N-A-XTRA HIGH-STRENGTH steel.

Write today for your copy of new illustrated technical brochure. Address Great Lakes Steel Corporation, Detroit 29, Michigan, Dept. X-6.

GREAT LAKES STEEL

A DIVISION OF NATIONAL STEEL CORPORATION



Here's a tough old squeezer that won't wear out

The donut-shaped steel disc in the main illustration is the mold plate used in a large hydraulic press. Under 2,000 tons of pressure, it squeezes an abrasive mixture in a mold to make grinding wheels. It's a tough job, and Waltham Grinding Wheel Company had to replace these discs every few months because they wore down and became unbalanced. Replacements were expensive and they wasted production time.

Finally, Waltham tried a plate made of USS "T-1" Steel. It has been used for more than a year now, and Waltham engineers say it will last indefinitely.

"T-1" constructional alloy steel has a minimum yield strength of 100,000 psi. It is exceptionally tough and resistant to abrasion—can be furnished heat treated to a minimum hardness of 321 Brinell. Compared to carbon steel, it has four times more resistance to atmospheric corrosion. In spite of its strength and toughness, "T-1" Steel can be formed, machined and welded. And because of its strength, it can be used in lighter gages, reducing weight as much as ⅔, depending on the application.

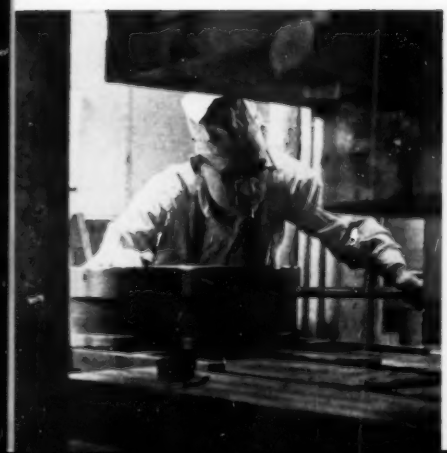
If you would like to have complete information about "T-1" Steel, write for our book "USS 'T-1' Steel," United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

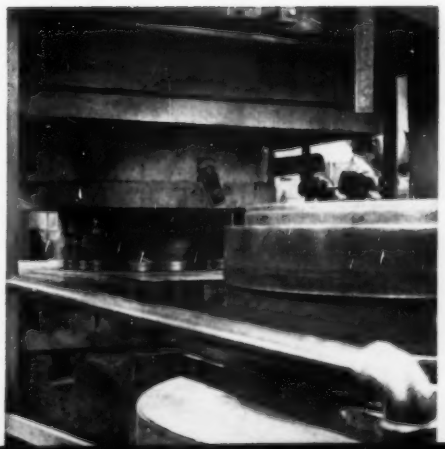
USS and "T-1" are registered trademarks

USS

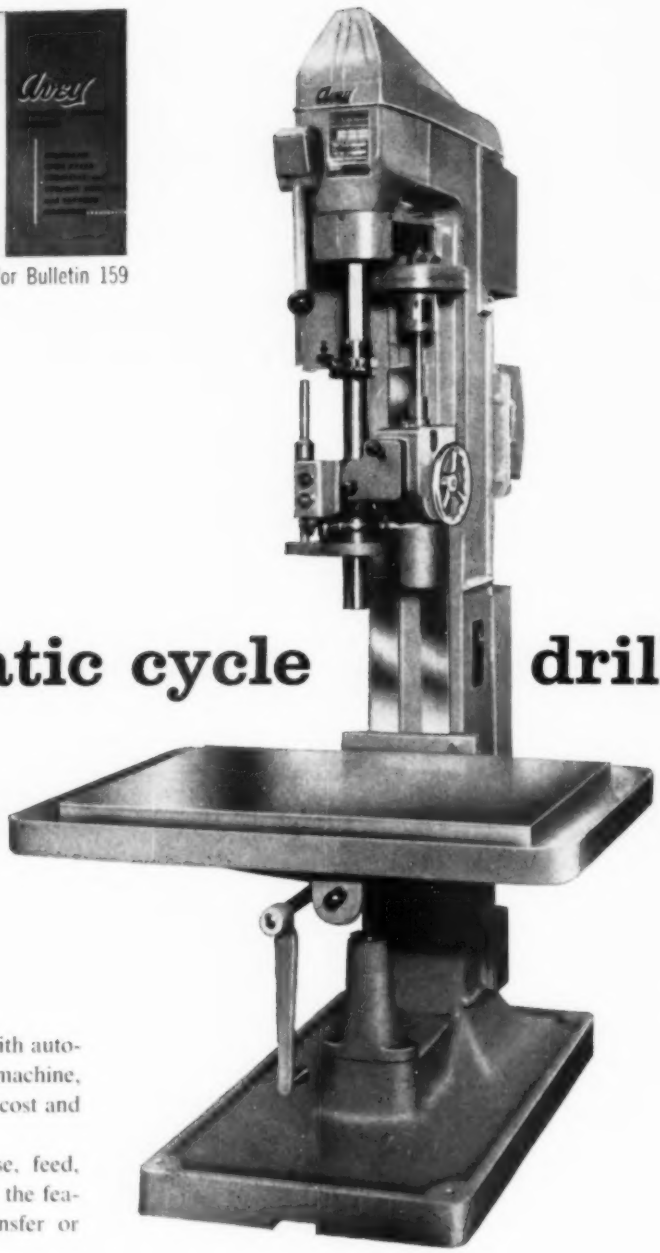
United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel





Write for Bulletin 159



automatic cycle drilling

■ You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit.

Adjustable rapid power traverse, feed, and rapid return of the spindle are the features which permit automatic transfer or rotary index fixturing.

At the same time, you get adjustable feeds, speeds, table travel, head travel, and Avey's advanced spindle construction.

The machine is available with No. 2, 3, and 4 Morse Taper; 1 to 3 HP motors; single or multiple spindles. Your request for additional information will be promptly answered. Avey Division, The Motch & Merryweather Machinery Co., P. O. Box 1264, Cincinnati 1, Ohio.

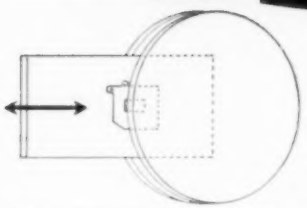
Avey

Gardner gun type fixturing lowers costs in grinding large area and odd shaped parts

surface grinds TWO sides parallel

in ONE operation

Gardner 2H30 Precision Double Spindle Grinder with gun type fixturing.



Typical large parts ground with gun type fixturing:
clutch races, bearing cones, valve plates, separator plates, deposit box doors, pump rings.

Advantages of Gardner reciprocating gun type fixturing

- heavy stock removal
- work holding paddles easily interchangeable
- profitable for short runs
- tolerances for flatness, parallelism and uniformity to "tenths"

Ask the Gardner Man for practical recommendations or write for latest catalog.

GARDNER

precision disc grinders

BELOIT, WISCONSIN

Carrying the LAPOINTE name plate with all that this means in engineering design and quality of manufacture,

this BENCH SIZE LAPOINTE

BROACHING MACHINE

fills a particular need in the field of broaching

PRICED AT $970, this small, compact LAPOINTE Broaching Machine is built for *precision broaching* — like all other Lapointe Broaching Machines. It is eminently suited to the broaching of

SMALL MISSILE PARTS

because of its ability to perform to the extremely close tolerances required in that field.

Such parts as missile valves, lock cylinder barrels, various slots, and other internal applications are broached easily on this machine. In certain instances, external and surface broaching can be satisfactorily performed. It is excellent for *finish broaching*, where stock removal requirements are not heavy.

Portable, and usable wherever it can be plugged into a 110v outlet, this small Pull Down Broaching Machine is designed with direct-line pull on the broach, thus eliminating the strain encountered when broaching with machines of the older type.

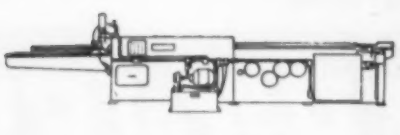
Write for Bulletin EB

THE LAPOINTE MACHINE TOOL COMPANY

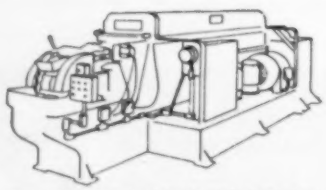
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

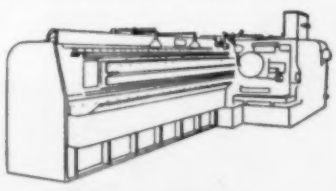
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



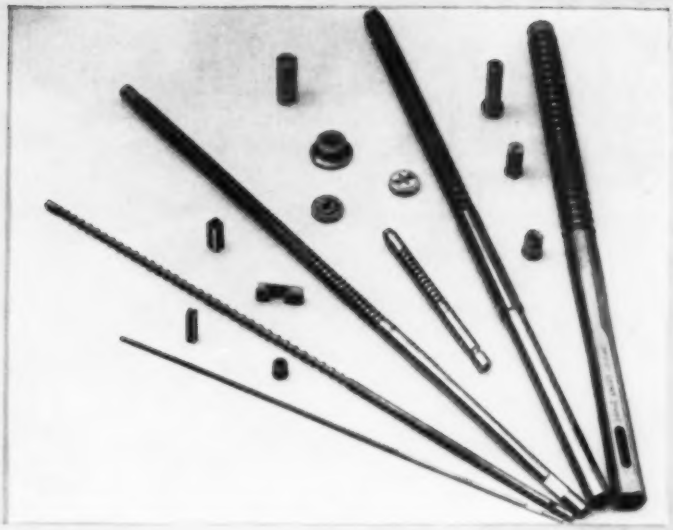
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC



SPECIFICATIONS

Lapointe EB Broaching Machine, 1½-ton, 12-inch stroke. Broaching speeds, 5 and 10 f.p.m.

Size of platen, 17" x 18½"

Hole in platen, 5"

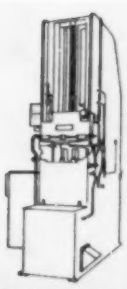
Hole in drawhead, 1½"

Floor area occupied, 20" x 31"

Height of platen from floor, 34"

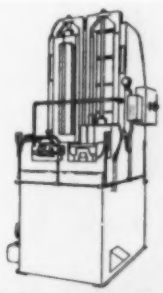
Motor required, ½ h.p.

Net weight, 500 pounds



VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC



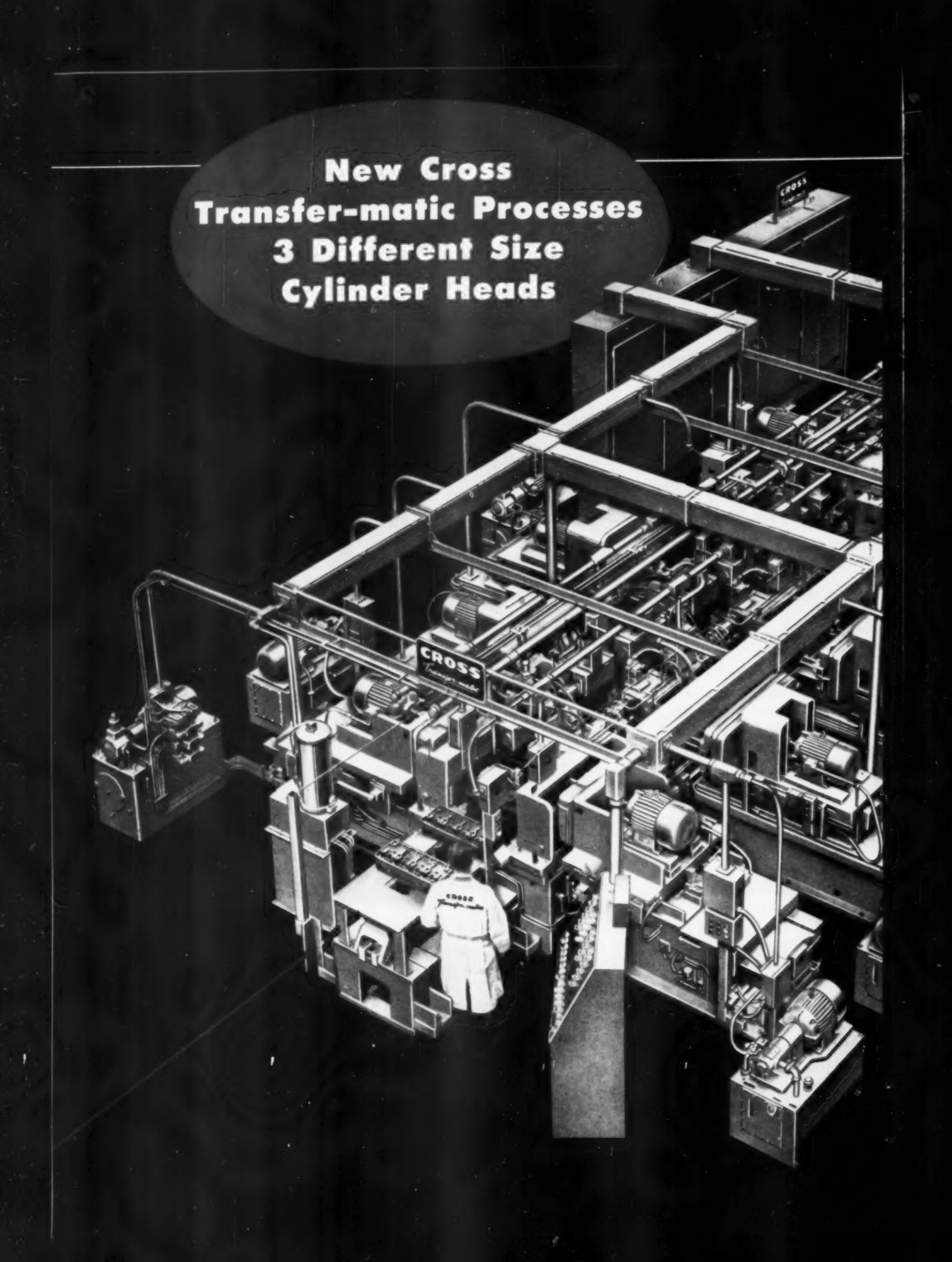
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

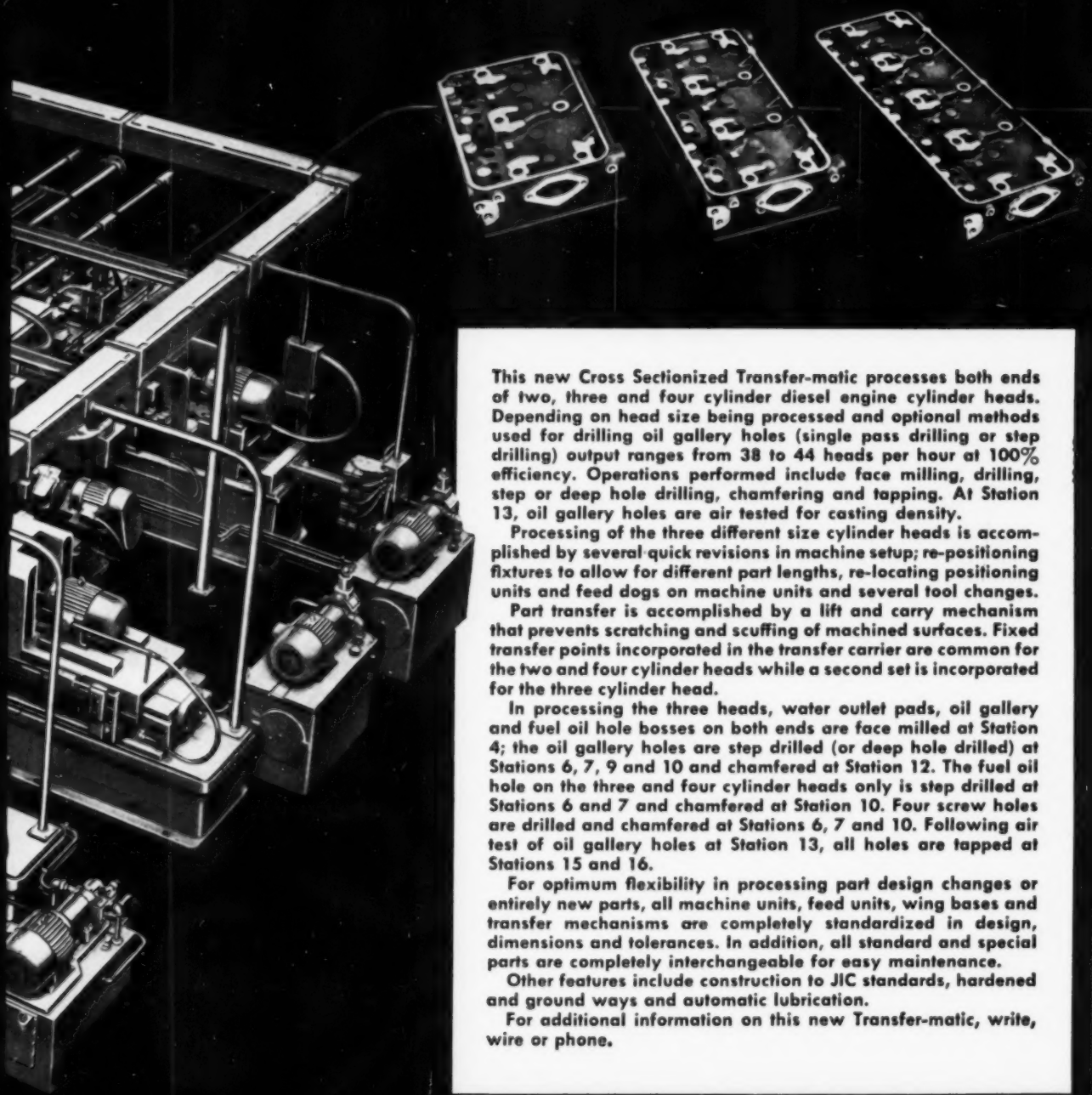
known to be the best in

BROACHING

New Cross Transfer-matic Processes 3 Different Size Cylinder Heads



Another Automation First by Cross



This new Cross Sectionized Transfer-matic processes both ends of two, three and four cylinder diesel engine cylinder heads. Depending on head size being processed and optional methods used for drilling oil gallery holes (single pass drilling or step drilling) output ranges from 38 to 44 heads per hour at 100% efficiency. Operations performed include face milling, drilling, step or deep hole drilling, chamfering and tapping. At Station 13, oil gallery holes are air tested for casting density.

Processing of the three different size cylinder heads is accomplished by several quick revisions in machine setup; re-positioning fixtures to allow for different part lengths, re-locating positioning units and feed dogs on machine units and several tool changes.

Part transfer is accomplished by a lift and carry mechanism that prevents scratching and scuffing of machined surfaces. Fixed transfer points incorporated in the transfer carrier are common for the two and four cylinder heads while a second set is incorporated for the three cylinder head.

In processing the three heads, water outlet pads, oil gallery and fuel oil hole bosses on both ends are face milled at Station 4; the oil gallery holes are step drilled (or deep hole drilled) at Stations 6, 7, 9 and 10 and chamfered at Station 12. The fuel oil hole on the three and four cylinder heads only is step drilled at Stations 6 and 7 and chamfered at Station 10. Four screw holes are drilled and chamfered at Stations 6, 7 and 10. Following air test of oil gallery holes at Station 13, all holes are tapped at Stations 15 and 16.

For optimum flexibility in processing part design changes or entirely new parts, all machine units, feed units, wing bases and transfer mechanisms are completely standardized in design, dimensions and tolerances. In addition, all standard and special parts are completely interchangeable for easy maintenance.

Other features include construction to JIC standards, hardened and ground ways and automatic lubrication.

For additional information on this new Transfer-matic, write, wire or phone.

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Start saving money right now on threading jobs like these with...

CRI-DAN SINGLE-POINT THREADING LATHES

...cut costs with simple single-point carbide tools. They're easily resharpened or replaced. They eliminate expensive upkeep of thread milling cutters or thread grinding wheels.

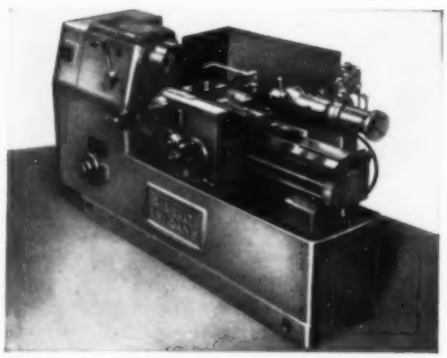
...assure extremely accurate lead and thread form and exceptional finish with low-cost carbide tools on materials that don't allow economical threading by other methods.

...handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

...set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches—thread up to shoulders on all types of internal and external operations.

...cut costs from start to finish with CRI-DAN's speed, versatility and economy.

Why put off the savings the CRI-DAN method can bring you *right now?* Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model B (shown) offers extreme flexibility with spindle speeds of from 154 to 2808 r.p.m.; 3' capacity between centers and 15½" swing over bed. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

MOLYKOTE®

LUBRICANT

metalworking news

PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE

These punches (11/16") were used to punch 25000 holes in ⅛", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"

- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

When writing, refer to Item 507

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembly

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505

Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. **Shortens "wear-in" period without use of abrasives.**
2. **Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.**
3. **Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.**
4. **Eliminates "stick-slip" behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metal.**
5. **Specifically designed for "wear-in" use. MoS_2 particles make intimate contact with bearing surfaces. Will not scrape off.**
6. **Need not be burnished into surface. Brush or wipe on a thin coating.**
7. **Inexpensive . . . a little goes a long way.**

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn. Phone: FIreside 8-3724.

SEE OUR CATALOG IN SWEET'S

THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 505 ☐ Item 507 ☐
Item 506 ☐ Item 508 ☐

Name .....
Company .....
Address .....
City .....
State .....

THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

. . . THROUGH RESEARCH

7 PLA-CHEK GAGES stand guard over Ford precision and accuracy in this Layout and Inspection room at Ford Motor Company's Dearborn engine plant in Dearborn, Michigan
1
2
3
4
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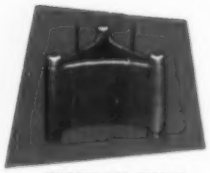
7

7 of 200 Reasons Why Inspections are *Faster at Fords!*



PRECISION RISERS

Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6" height for 6", 12", 18" PLA-CHEKS . . . 12" height for 24", 36", 48" models.

MICROMETER THIMBLE

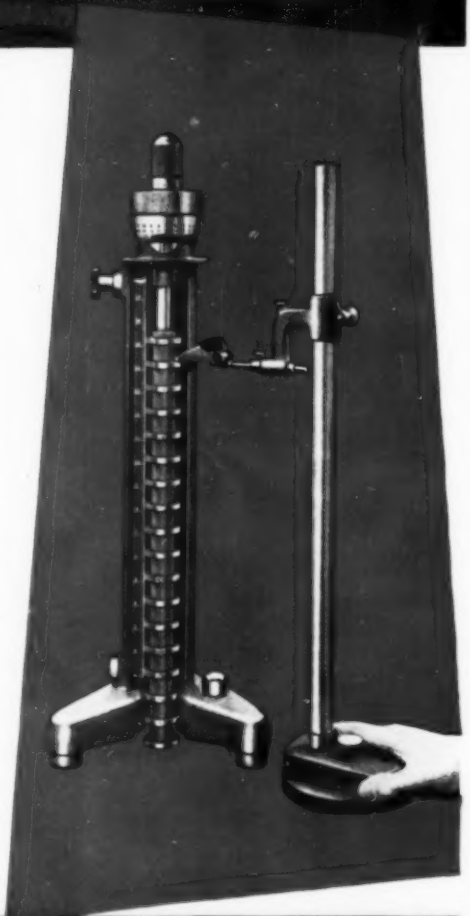
is graduated to .0001" and provides dimensions between 1" steps on measuring bar. Measuring bar of the 18" model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

PLA-CHEK GAGES Guard Ford Precision while Cutting Inspections from Minutes to Seconds

Precision is a law at Ford Motor Company. And speed is essential to the maintaining of high volume production. That's why you'll find more than 200 PLA-CHEK Gages at work in various Ford plants speeding inspections while guarding Ford precision and quality.

PLA-CHEK GAGES, available in a full range of sizes to meet every surface plate inspection and layout requirement, can be set 5 to 20 times faster than other methods of comparable accuracy. They are guaranteed accurate to .00005" throughout the entire range of the 6", 12" and 18" sizes and in the 24", 36" and 48" sizes to .0001" in any 24" length or .0002" over their entire range.

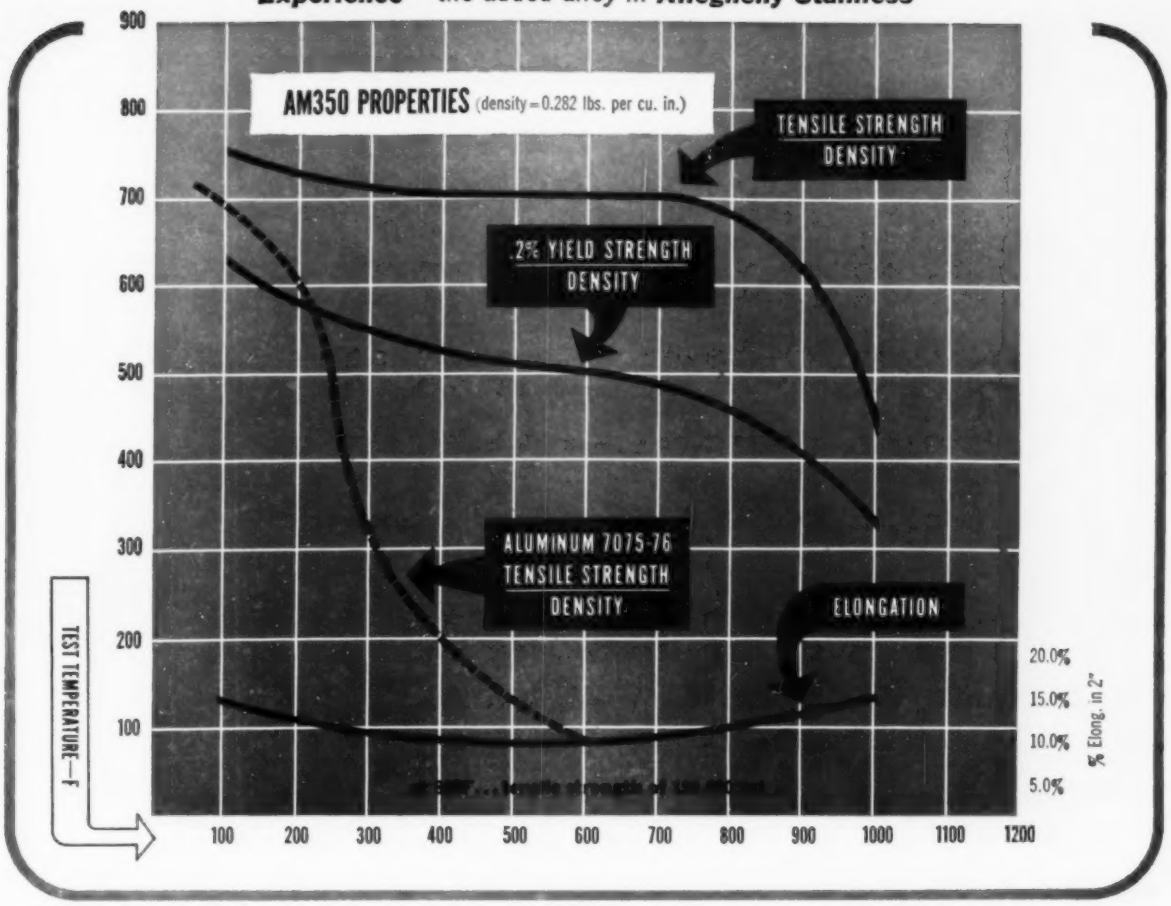
In August, 1946 Ford Motor Company purchased its first PLA-CHEK Gage. Today there are 200 at work in Ford inspection rooms and at Ford machines. Such confidence on the part of Ford Engineers must be deserved. Let us tell you how you, too, can speed inspections, maintain extreme accuracy and save money with PLA-CHEK Gages. Write for complete, detailed literature.



Cadillac GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN

Experience *— the added alloy in* ***Allegheny Stainless***



Two for the space age—AL's AM-350 and AM-355 precipitation hardening steels

A unique combination of highly desirable properties describes Allegheny Stainless AM-350 and AM-355 Steels. They combine high strength at both room and elevated temperatures, excellent corrosion resistance, ease of fabrication, low temperature heat treatment, good resistance to stress corrosion.

They are proving the answer to many space age problems. Airframe and other structural parts, pressure tanks, power plant components, high pressure ducting, etc. are all natural missile and supersonic aircraft applications for AM-350 and AM-355.

AVAILABILITY: AM-350, introduced several years ago, is available commercially in sheet, strip, foil, small bars and wire. AM-355, best suited for heavier sections, is available commercially in forgings, forging billets, plates, bars and wire.

CORROSION RESISTANCE: Compared to the more familiar stainless grades, AM-350 and AM-355 resist corrosion and oxidation better than the hardenable grades (chromium martensitic) and only slightly less than the 18 and 8's. They resist stress corrosion at much higher strength levels than do martensitic stainless grades.

SIMPLE HEAT TREATMENT: High strength is developed by two methods. Both minimize oxidation and distortion problems. The usual is the Allegheny Ludlum-developed sub-zero cooling and tempering (SCT): minus 100F for 3 hrs plus 3 hrs at 850F. Alternate method is Double Aged (DA): 2 hrs at 1375F plus 2 hrs at 850F.

EASY FABRICATION: AM-350 and AM-355 can be spun, drawn, formed, machined and welded using normal stainless procedures. In the hardened conditions, some forming may be done . . . 180 degree bend over a 3T radius pin. Also AM-350 can be dimpled in the SCT condition to insure accurate fit-up.

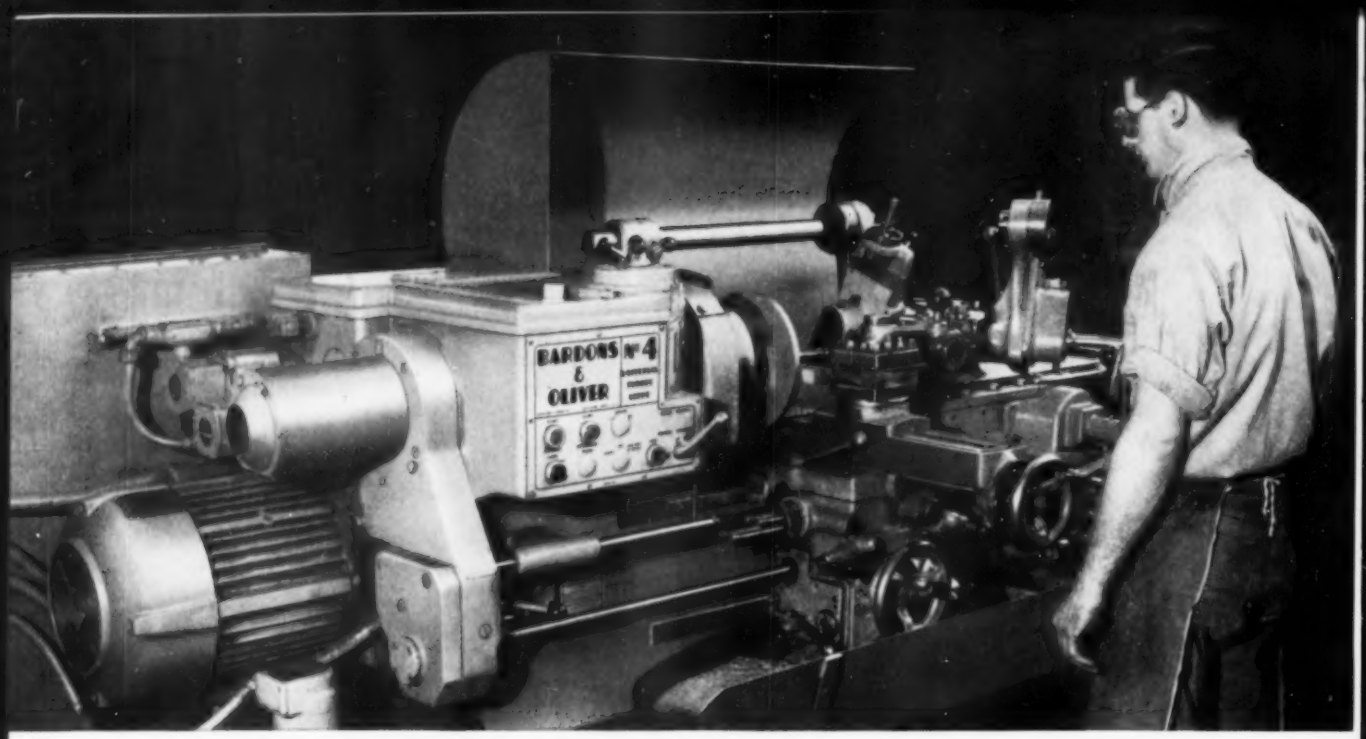
For further information, see your A-L sales engineer or write for the booklet "Engineering Properties, AM-350 and AM-355." ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa. Address Dept.*** *AM-18.*

WSW 7516

ALLEGHENY LUDLUM

Export distribution: AIRCO INTERNATIONAL

EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT



BARDONS & OLIVER
NO. 4 TURRET LATHE

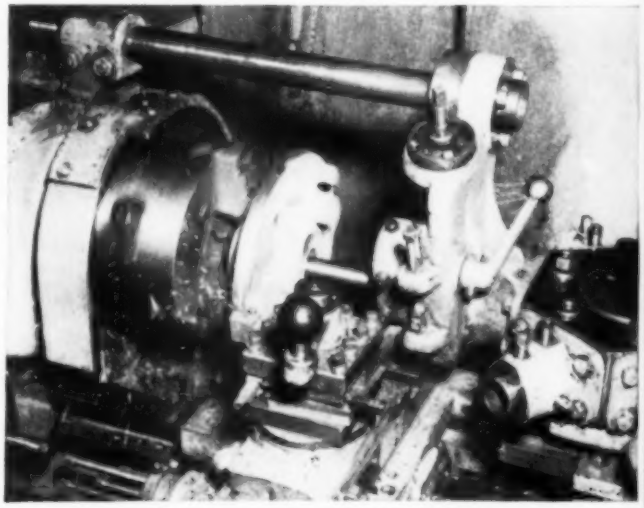
"Biggest Money-Maker in the Plant"

Reports W. W. McCain, Jr., Factory Manager, Chicago Machinery Laboratory, Inc. This progressive firm manufactures automatic signature feeders and magazine trimmers. Mr. McCain further states:

"The addition of the No. 4 Bardons & Oliver has allowed us to reduce direct labor in the turret lathe department, and at the same time increase output by 50%. Over 600 different parts are made on the machine. Extreme accuracy of the No. 4 allows us to hold bearing diameters within ±.00025"; at the same time high spindle speeds, heavy feeds, and combined and multiple cuts allow full utilization of the 15 HP main drive motor. The machine is very convenient to setup and operate. During two years of 100 hours a week operation, downtime on the No. 4 has been negligible.

We feel that the Bardons & Oliver No. 4 is the most compact and efficient turret lathe available having 18" swing over the bedways. By making a totally different turret lathe for each range of work, Bardons & Oliver offers just the right size machine for any job."

Your Bardons & Oliver representative will welcome the opportunity to discuss with you the profit possibilities offered by these turret lathes.



Rough turning & boring 11-1/2" O. D. cast iron cam follower wheel.

BARDONS & OLIVER

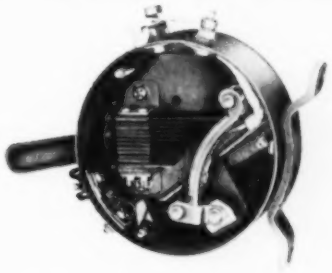
BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

Instantly,
Smoothly,
new "Contact Bronze"
applies graduated power
to heavy-duty trailer
brakes

CONTACT!

COSTS 25% LESS
These contact leaves are stamped and formed from Bridgeport "Contact Bronze" Alloy 92 at a savings of 25%. Its performance-proved spring properties provide part reliability through thousands of cycles.



FORMS EASILY
Warner Electric Brake system for heavy-duty trailer combination is actuated by this controller. This view shows the series of easily formed "Contact Bronze" leaves that transmit power in smoothly graduated steps.

This ingenious electric brake system devised by Warner Electric Brake & Clutch Company gives the driver instantaneous synchronization of all brakes. Through a graduated series of Bridgeport "Contact Bronze" leaves, it lets the driver adjust torque smoothly to suit load and road conditions.

"Contact Bronze" Alloy 92 saves up to 25% on material cost. Its quality and dependability are maintained by the addition of a minute quantity of phosphorus for superior spring properties. It easily withstands difficult forming operations without losing its spring properties.

If you form or stamp contact parts for electrical or electronic equipment, you will want details on "Contact Bronze," as well as Bridgeport's other alloys for the electrical industries. Call your nearby Bridgeport sales office for immediate service or, for samples and a copy of the "Contact Bronze" data sheet, write to Dept. 3006.

Bridgeport Brass Co.

BRIDGEPORT BRASS COMPANY
Bridgeport 2, Conn. • Sales Offices in Principal Cities
*Specialists in Metals from **A**luminum to **Z**irconium*

◄ CIRCLE 200 READER SERVICE CARD

CIRCLE 201 READER SERVICE CARD

THE LINK BETWEEN ELECTRONIC CONTROL AND HYDRAULIC POWER

Expert Welding Machine Co. Solves the High Production Contour Welding Problem With

VICKERS

Electro-Hydraulic Servo Valve

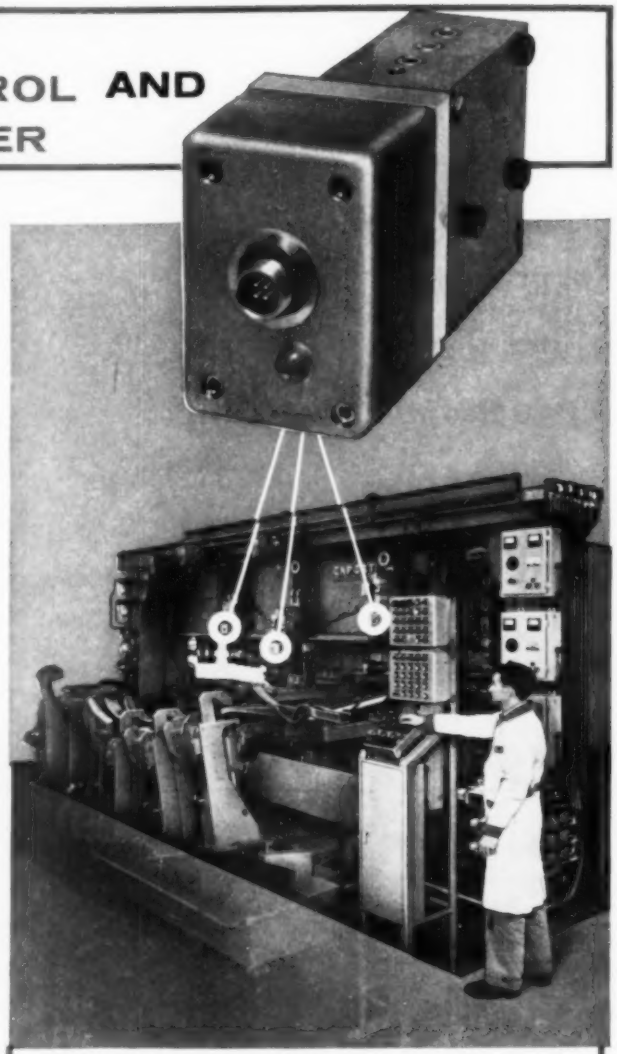
The versatility of electro-hydraulic control of power has solved one of industry's toughest problems — automatic welding of complex and contoured automotive frame members.

An electronic probe follows the weld line on the work and records any deviation from the path prescribed by a master cam. Any deviation from the governing cam contour creates an error signal which is amplified and fed to the servo valve. The servo valve converts these electrical signals into precise hydraulic flow to a cylinder which accurately positions the welding head allowing for variations in manufacturing operations . . . trimming, etc.

This application is only one of many in which Vickers Servo Valve has demonstrated exceptional performance under the exacting conditions of industrial production requirements.

Valve operation is simple. Reliability is assured—there are only four moving parts.

Investigate the production advantages offered by electro-hydraulics. **Write for Vickers Engineering Bulletin 58-74.**



EXPERT WELDING MACHINE COMPANY developed this automated welding machine that incorporates a magnetic-tape-tracer system. Vickers electro-hydraulic servo valve provides the link between electronic programming and hydraulic power. Vickers Pumps and Controls also used. The machine joins metal parts having untrimmed, out-of-tolerance, straight and/or contoured weld line edges.

Two U-shape channels are welded to form the box configuration in this complex automotive frame side member. Production is approximately 100 pcs/hr.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1410 • Detroit 32, Michigan

8259

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

YESTERDAY'S PIONEER . . . TODAY'S LEADER

NEW! WELDON

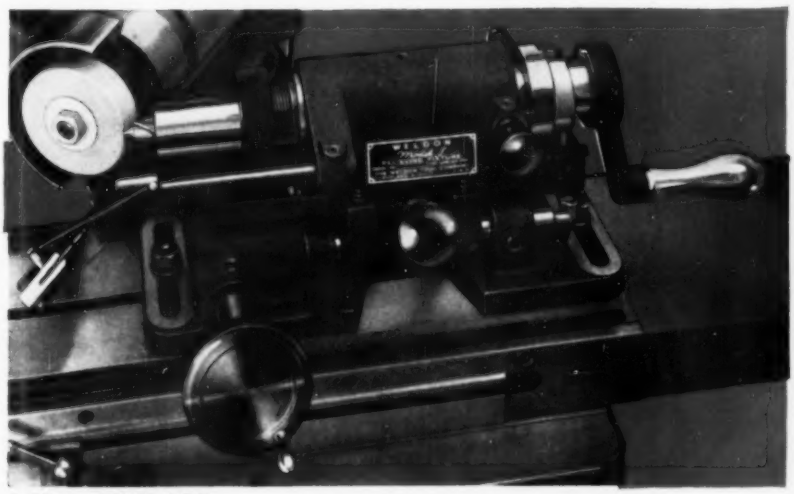
Model ∫ RELIEVING FIXTURE

For Sharpening ∫ Point Drills and other End Cutting Tools

CAPACITY—3/32" TO 3/4" DIA. INCLUSIVE

TAKE ADVANTAGE OF THESE FEATURES OF ∫ POINT DRILLS

- SELF-CENTERING
- LONGER TOOL LIFE
- GREATER ACCURACY
- FINER FINISH



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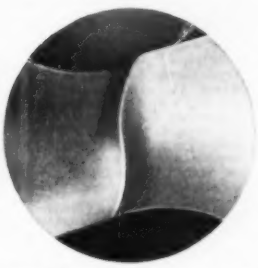


SHOWING MAGNIFIED VIEWS OF THE ∫ POINT GROUND ON WELDON MODEL ∫ RELIEVING FIXTURE

IN ADDITION TO DRILL POINTING, THE WELDON MODEL ∫ RELIEVING FIXTURE IS IDEALLY SUITED FOR SHARPENING OTHER TYPES OF CUTTING TOOLS SUCH AS:

TAPS

WELDON COUNTERSINKS AND DEBURRING TOOLS

STEP TOOLS, ETC.

SEND FOR DETAILED INFORMATION:
WELDON DISTRIBUTORS THROUGHOUT U.S.A. AND CANADA CARRY COMPLETE STOCKS TO SERVE YOU

OVER 40 YEARS OF LEADERSHIP SINCE 1918

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

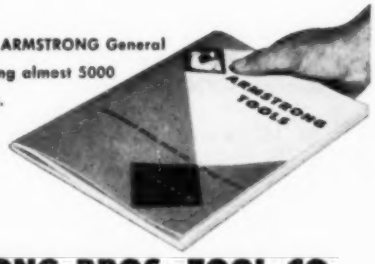
Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

EXTRA DEEP THROAT "C" CLAMPS

Provide extra clearance required for some work. Extremely stiff for weight. Screws and hubs are accurately machined and aligned with machined seats; have sliding pin handles and free-acting swivel caps on point. Bodies have smooth sandblast finish.
(8 sizes to 12" opening)

Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools.



ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.

HEAVY DUTY "C" CLAMPS

Universally recognized as strongest "C" clamps made. Longer hub holds screw alignment against terrific side strain; permit tighter clamping and multiplies thread friction against loosening. Extra large screws are heat treated and hardened at point.
(11 sizes to 12½" opening)

MEDIUM SERVICE "C" CLAMPS

The design and careful selection of steels in this type clamp combine to give it maximum strength and stiffness consistent with convenient weight. Heat treated screw with sliding pin handle and swivel cap on point. Ground seat.
(9 sizes to 18" opening)

TOOL MAKERS "C" CLAMPS

Quality steels, drop forged, heat treated and accurately machined with ground seats. Drop forged screws have both "wing nut" handle for convenience and square necks for tight setting with a wrench. Either "plain" or "swivel" screw types.
(Four sizes: 1", 2", 3" or 4" maximum opening)

SPATTER RESISTANT WELDERS "C" CLAMPS

Extra Deep Throat Pattern (see above). Body, Swivel and Screw are cadmium plated over all to resist welding spatter.
(8 sizes Capacities to 12" opening)

MACHINISTS' CLAMPS

Jaws drop forged, carefully machined and hardened, are extra heavy; will not bend or spring on a short bite and are faced true. Will grip non-parallel surfaces because the under face of the center screw is convex, fitting into a concave seat for tilting.
(Four sizes: Capacities to 4¼" opening)

PARALLEL CLAMPS

Carefully machined from selected grade steel and hardened. Particularly suited for holding work together when drilling or tapping. Rounded jaw ends increase clearance in close quarters. Spring clip holds loose pin in alignment while tightening or loosening.
(3 sizes: Capacities to 2½" opening).

Feature for feature,
Price for price...

this CINCINNATI 16" ROYAL DRILL is your BEST DRILLING BUY!

CHECK LIST FOR DRILLING AT A PROFIT

SPINDLE ACCURACY
6-spline spindle mounted in 4 precision bearings—one at TOP and bottom of spindle pulley.

BUILT-IN ELECTRICS
Complete controls with overload protection built into the head.

POSITIVE DEPTH GAGE
Easy-to-read gage is graduated in 1/16". Quickly set for positive stop at desired position.

RAPID SPEED CHANGE
Tilting motor bracket provides easy belt shifting for five spindle speeds.

SPACIOUS TABLES
Large working surface of tables and bases, with massive 3" column design provide unusually wide work range.

APPEARANCE
Streamlined functionally for maximum safety and operating ease.

ACCESSORIES
Profit-boosting attachments and accessories include automatic air feeds, electrical tapping units, motor driven coolant pump, and others.

The CINCINNATI 16" ROYAL Drill is a real metal-working drill, built to machine tool quality standards by a machine tool builder. This is a multi-purpose machine—it handles light drilling on a production basis, as well as being ideal for utility operations. With CINCINNATI quality built-in, a ROYAL holds its accuracy longer—stays on the job longer.

*Only $128 for the Cincinnati 16" Royal bench type drill shown. Complete with 0"—½" chuck or #2 M.T. spindle, built-in single phase manual control with overload protection—less motor. Floor model, as above, only $143.

ROYALS are built in bench and floor types, single and multiple spindle 16" models with ⅝" drilling capacity in cast iron. Also 18" models with 1" capacity in cast iron.

Talk it over with your CL&T Dealer, or write us direct.

Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

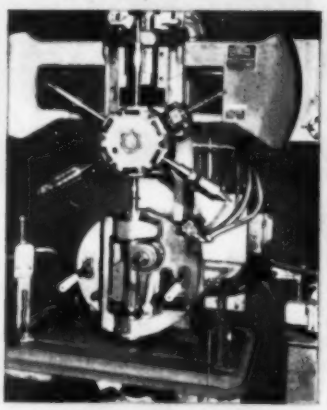
3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

"Roticul" Parts Machined
BURGMASTER automatic hydraulic

Roticul Rotary Tiller is only one of the many power garden tools built by Simplicity Manufacturing Co., Port Washington, Wisconsin. Others include Wonder-Boy Riding lawn mowers, garden tractors, cultivators, spray equipment, etc.

Cast iron Roticul Rotary Tiller parts now machined three times faster on the Burgmaster Turret Drill over former turret lathe operation.



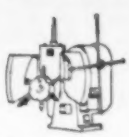
Close-up showing large carbide tipped multiple boring, reaming, grooving, c'boring, and spot facing tools with nylon wear strips. Not special 180° indexing fixture which is electrically safe-guarded for proper index position for respective tool.

Specialists in High Production Turret Drilling

"O" Manual Power Index · ⅛" Capacity

1C Manual Power Index ⅜" Capacity

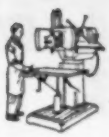
2B Manual Power Index ¾" Capacity



2BF Flange Mounted Power Index ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



2BR Ram Type Radial Drill ¾" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

3 Times Faster....

6 SPINDLE TURRET DRILL

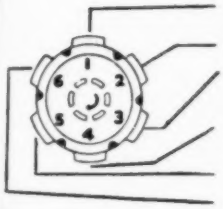
at Simplicity Manufacturing Company, Port Washington, Wisc.

Another example of good tooling on a Burgmaster Automatic Hydraulic Turret Drill pays off 3 to 1 in addition to a direct labor savings of $.147 per part. The cast iron housing was formerly machined on a turret lathe in 6.5 minutes, and is now machined on the Burgmaster in 2.3 minutes. Twelve operations are performed by special multiple cutting carbide tools on the 6 turret spindles. The tools have nylon wear strips and are piloted in steel bushings in the 180° and 15° indexing fixture. The fixture is electrically safeguarded to assure the proper index position for the respective tool. Burgmasters are pace-setters, automatically doing the work and the thinking — requiring only loading, unloading, and starting by pressing a button.

The efficient, automatic machine functions of the Burgmaster 2BH Turret Drilling, Tapping, and Boring Machines makes possible these production improvements. The turret is power indexed, permitting skip indexing, if desired, to provide different combinations of machining cycles. Spindle speeds and feeds are pre-selected and automatically shifted for each spindle to keep tools cutting at their optimum rates. Feeds are infinitely variable and quickly adjusted from standard controls.

In addition, accurate micro adjustable depth control for each spindle is provided, and automatic rapid approach and return saves valuable machine time and speeds the machining cycle. All operations are performed at the most efficient rate commensurate with fine finish, accuracy, speed and longest tool life.

How The Job Is Run



	Operations	Diameter	Speed	Feed
1.	Ruf. & Fin. Bore, Spot Face Bearing Bore	1.800 1.844	1300	.008
2.	Fin. Ream Bore	1.8504	1300	.012
3.	Machine 2 Ring Grooves in Bore — Index Fixture 15° for Tapping Hole		720	.006
4.	Tap Pipe Plug Filler Hole ⅜" Index Fixture 180° for opposite end		450	.055
5.	Rug. & Fin. Bore & C'bore	.900,962 1.362	1300	.008
6.	Fin. Ream & Counterbore	1.005, 1.375	720	.016

Maximum Flexibility Is Assured

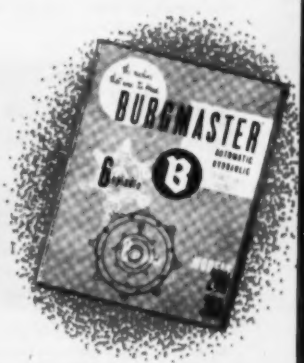
Because all machine functions are adjustable, the machine can be set up with different tools and fixtures in approximately one hour or less to produce other parts — automatically. This convenience permits some manufacturers to carry small inventories of parts.

Burgmasters may be supplied as complete production units, including fixtures and tools ready to go into production. With proper tooling, they will replace many different types of machines to effect substantial savings, increase production, and cut costs. Why not ask a Burgmaster field engineer to call? There is no obligation.

Job Facts

Machine: Burgmaster 2 BH Automatic Hydraulic Six Spindle (2 H.P.) Turret Drilling, Tapping and Boring Machine.
Company: Simplicity Manufacturing Co., Port Washington, Wisc.
Part: Cast Iron Housing for Rotcul.
Quantity: Continuous Production.
Fixture: 180° and 15° Indexing Fixture Electrically Safeguarded for proper Index Position of Port for Respective Tool.
Tools: Special Carbide Multiple Cutting, with Nylon Wear Strips.
Tolerances: .001 Bearing Bores; .002 Seal Bores.
Former Method: Turret Lathe
Former Time: 6.5 Minutes
Present Time: 2.3 Minutes
Savings: $.147 Direct Labor Per Part, Production Increased 3 to 1.

Write for bulletin describing Burgmaster 6 and 8 spindle Automatic Hydraulic Turret Drills in detail. Thirty-minute 16mm sound film showing Burgmaster turret drills in operation, including the new automatic positioning table, available from any Burgmaster office.



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BURGMASTER B

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Plus dealer representatives in other industrial centers.

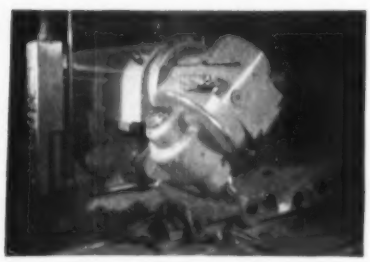
SUNDSTRAND

"ENGINEERED PRODUCTION" NEWS

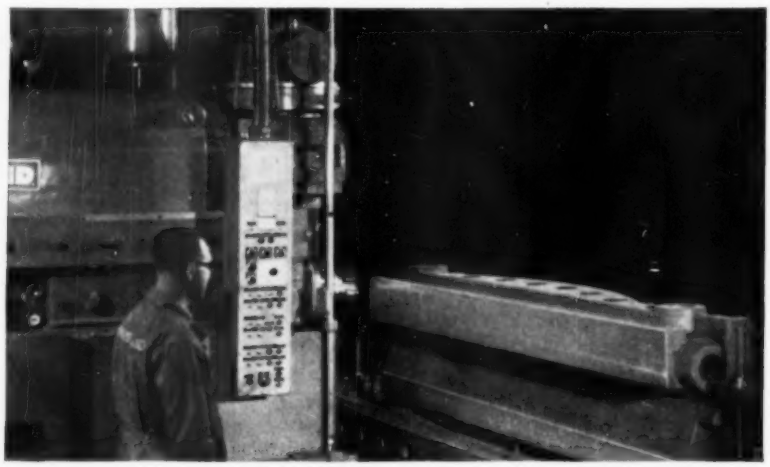
Universal Bed Type Rigidmil Combines Flexibility with High HP in Cutting Costs on Large Work

Machining end of work piece is illustrated in this example using all angle head in horizontal position and vertical feed.

Machining on top of the work is illustrated in this example using the All Angle head and longitudinal table feed.



All angle head is used to mill clearance cuts at an angle using transverse feed. All power feeds are infinitely variable.



Horizontal spindle and longitudinal table feed are used for face milling first surfaces of large casting.

Because this universal bed-type Rigidmil milling machine was able to machine a total of 28 surfaces on this large, heavy casting in just two setups, sizable savings were effected through a reduction in handling and setup times. Production is not sacrificed to gain flexibility as both the horizontal spindle and the all angle head have the horsepower needed for heavy cuts using carbide cutters, 50 and 20 hp respectively.

Positioning the cutter instead of the work, eliminates special fixtures needed to machine complex angles on conventional machines, and reduces set-up time. Accuracy standards invariably exceed those possible on other machines because of the reduction in workpiece handling.

Machine has a table feed stroke up to 216 inches, transverse feed stroke of 24" and vertical feed stroke of 26" making possible machining on large work pieces. Pushbutton pendant control of all machine speeds and movements enables the operator to keep close control over every type of job.

In addition, slab milling can be performed with the main spindle by mounting an arbor support on the dovetail ways provided. An extra cost option is a power operated draw rod for the horizontal spindle that simplifies cutter change.

AUTOMATIC LATHES | MILLING MACHINES | SPECIAL MACHINES | DRILLING MACHINES | GRINDERS

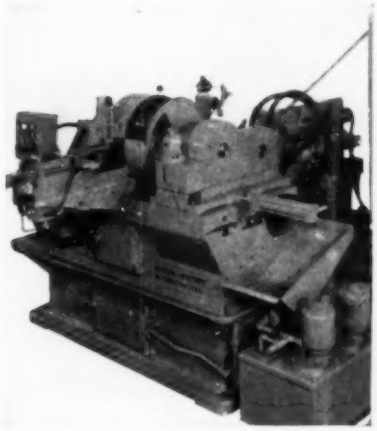
SUNDSTRAND

Steering Gear Part Thread-Milled in Automatic Setup

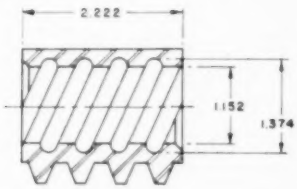
A two pass operation that leaves minimum stock to be removed in a following finish-grinding operation is used to produce approximately 72 ball nut components for automotive steering gears per hour on this Sundstrand Hanson-Whitney thread milling machine. Material is SAE 5120 steel.

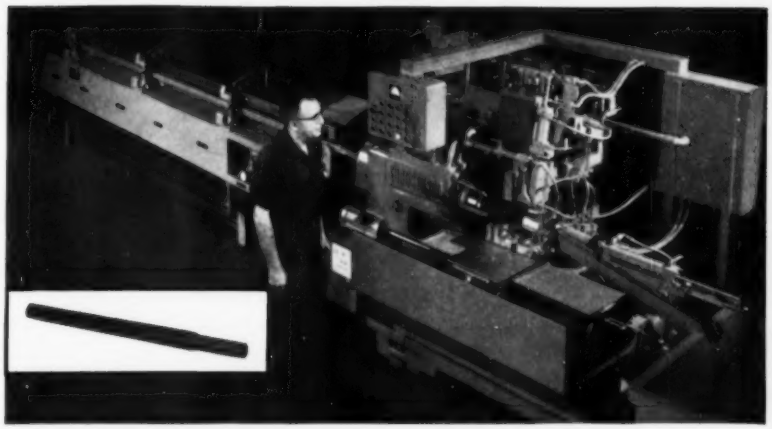
Because of the limiting physical dimensions of the cutter (small diameter in relation to length) a rough cut and finish cut are made to hold stock to a minimum for final grinding operations. Both rough and finish cuts are in one automatic cycle.

The completely automatic cycle, including load and unload, permits the operation to be handled with minimum operator skills and allows one operator to handle several machines.



Hanson-Whitney 10 x 24 inch machine built by Sundstrand equipped for automatic production, including load and unload, of automotive component. Principal dimensions of ball nut unit are shown below.





Hopper-Fed Sundstrand Lathe Turns 450 Shafts Per Hour

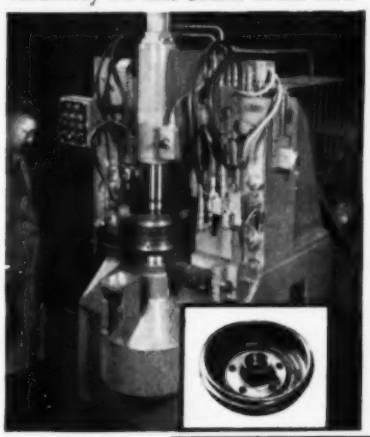
A special hopper arrangement for automatic feeding of bar stock to permit continuous cycling helps this Model 6A Sundstrand Lathe set a fast production pace. Fractional horsepower motor shafts are turned at an average rate of 450 per hour with lengths of finished shafts ranging from 9 to 13 inches.

Bar stock is fed automatically thru the spindle; is cut to length, turned, and grooved; and is automatically ejected onto the conveyor at the completion of the machine cycle. Front, rear, and overhead tools are provided to reduce machining time.

Because production requirements change frequently, quick setup tooling using micrometer tool blocks and stops is used. Not only does this permit reduced change-over time but it also eliminates the need for trial cuts at the start of a new production run.

Ceramic Tooling Keeps Brake Drum Output High

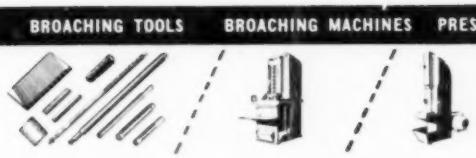
Combining ceramic tooling with the modern design features of the Sundstrand vertical lathe has opened the way to new highs in production efficiency on this brake drum turning operation. Hourly production is now at 72 units per hour at 80% efficiency, at nearly double the surface speed used with carbides. Surface finishes exceed any previously attained, eliminating the need for a sanding operation formerly required.



Easy loading and unloading made possible by the vertical lathe design play an important role in the increased production rate. Open front vertical machine makes it easy to provide automatic chip disposal, an important advantage in view of the high rate of metal removal.

Learn more about how Sundstrand "Engineered Production" can solve your machining problems by writing for Bulletin 104 today.

BROACHING TOOLS BROACHING MACHINES PRESSES



SUNDSTRAND MACHINE TOOL
Div. of SUNDSTRAND CORPORATION
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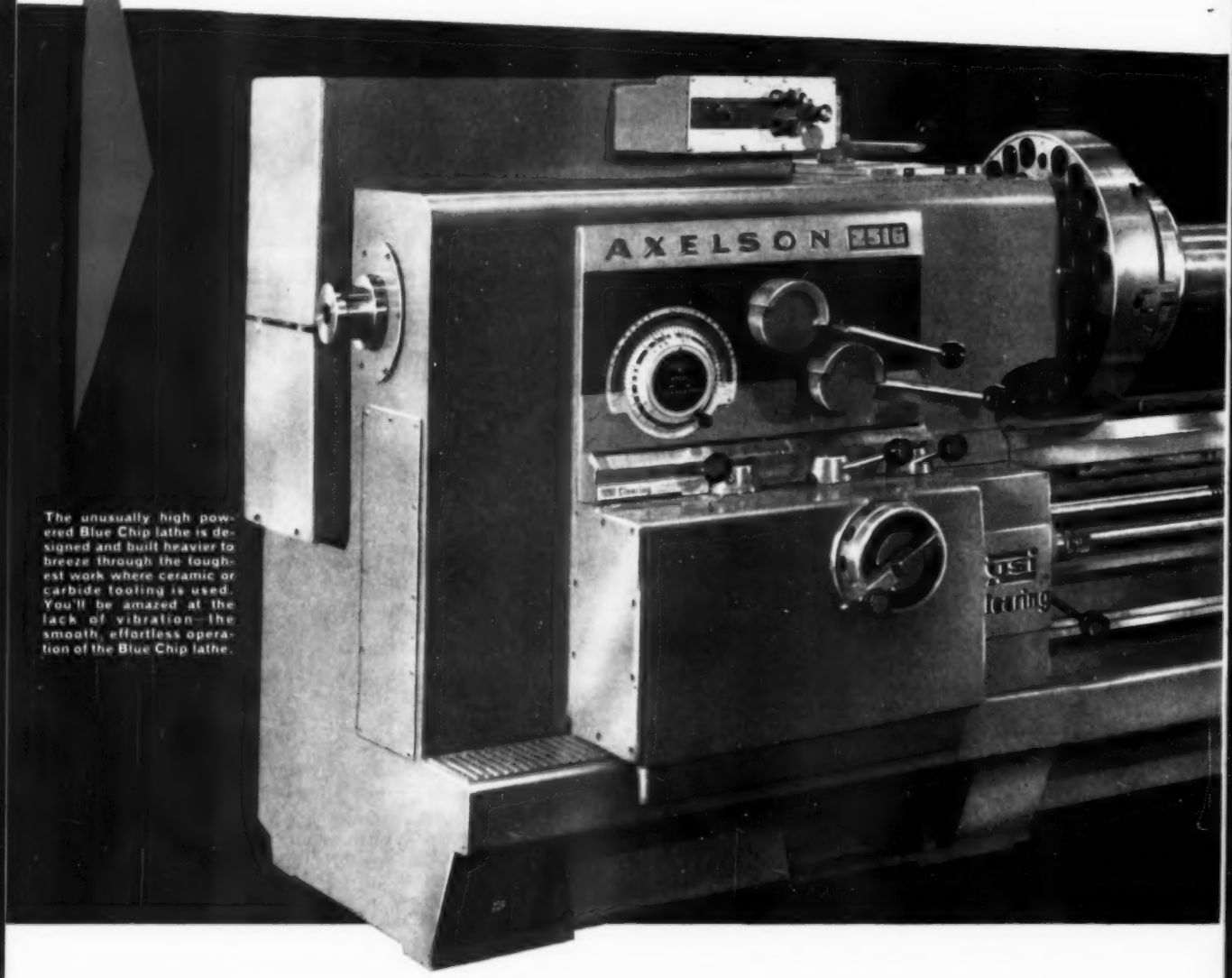
HERE'S the World's finest Lathe Value—it costs no more

THE NEW WELDED STEEL CLEARING-AXELSON



The unusually high powered Blue Chip lathe is designed and built heavier to breeze through the toughest work where ceramic or carbide tooling is used. You'll be amazed at the lack of vibration—the smooth, effortless operation of the Blue Chip lathe.

Clearing, division of U.S. Industries, Inc. also manufactures power presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.

HERE ARE THE PLUS FEATURES YOU'LL

- **Built especially for carbide and ceramic tooling—Heavier and faster cutting**
- **No vibration even on toughest jobs—Means precision finishes and longer tool life**
- **All steel welded construction—18 times more rigid than any other lathe**
- **"Building Block" Bed and headstock construction—Prevents obsolescence**
- **"Unitized" Design of drive, gearing, controls, electrical equipment—Easier routine maintenance**

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BLUE CHIP LATHE

The lathe above is the Blue Chip 2516 or 20" lathe. These machines are also standard in 16" and 25" sizes. Special lathes will be built to your particular requirements.

FIND ON THE BLUE CHIP LATHE

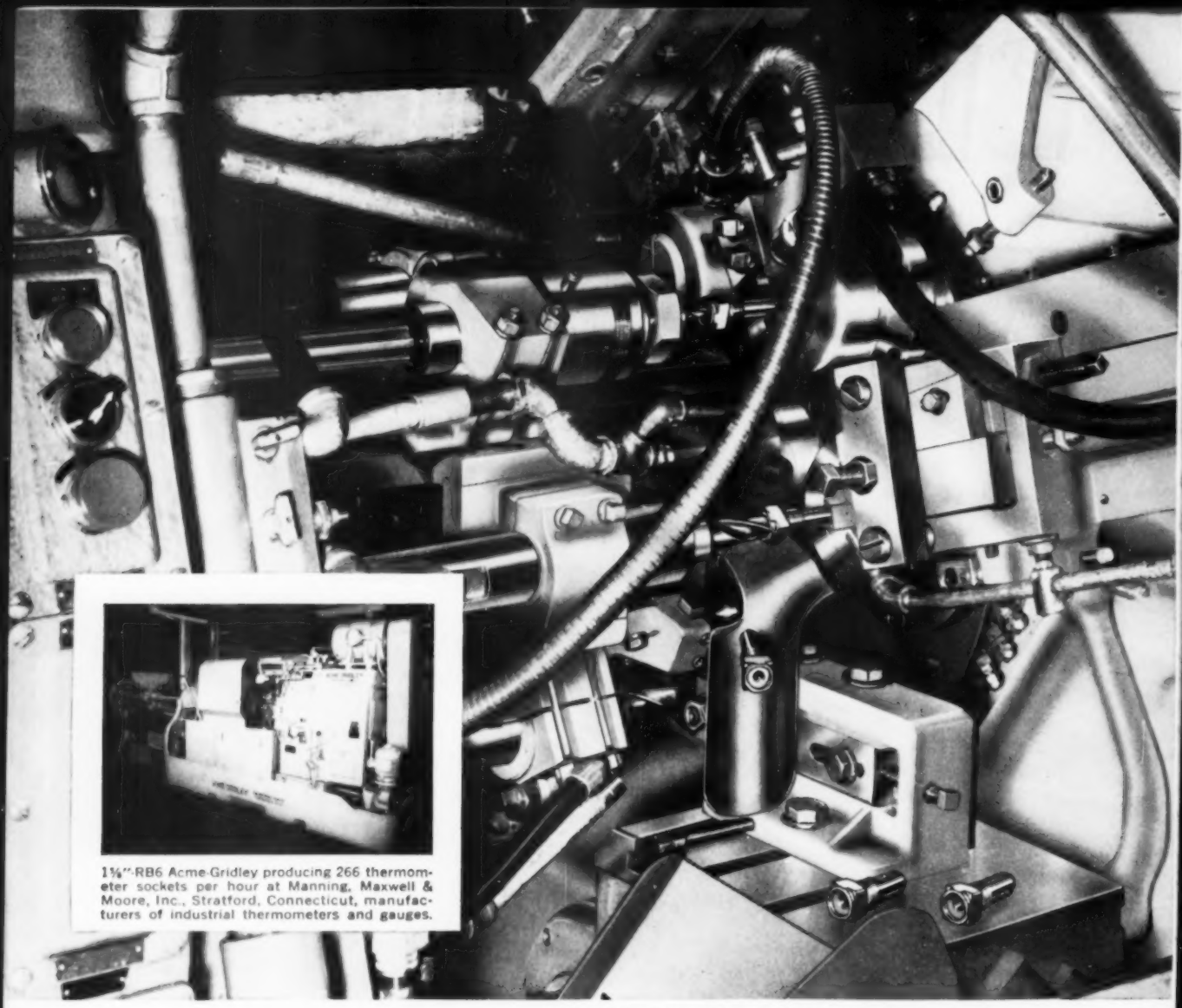
- Bed and headstock "Built-to-the-Floor"—For extra rigidity
- Forty spindle speed selections—More than any other lathe, Offers precise cutting control
- Eighty-eight feeds and threads—To suit any need
- Higher speeds—Up to 2,000 R.P.M.
- Faster setups
- Economical power shift options
- Direct reading digital tail stock dial—Saves time in drilling and boring
- Horsepower meter—insures efficient cutting at all times
- 4-Way rapid traverse available

GET THE FULL STORY

It's told in this new catalog on the Blue Chip Lathe. Your free copy is ready now.

◀ CIRCLE 210 READER SERVICE CARD

CIRCLE 211 READER SERVICE CARD



1¼"-RB6 Acme-Gridley producing 266 thermometer sockets per hour at Manning, Maxwell & Moore, Inc., Stratford, Connecticut, manufacturers of industrial thermometers and gauges.

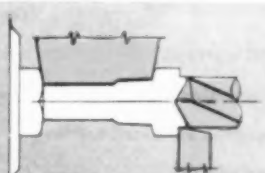
Close-up of tooling zone showing 4th and 5th position operations.

Spindle-for-Spindle

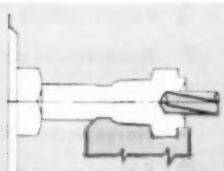
PRODUCTION INCREASED OVER 200%

for Manning, Maxwell & Moore, Inc.

12 Operations in 22 Seconds



6. **Rough Form Rear Diameters —Spot Drill—Turn Front Diameter**



1. **Finish Form Thread and Front Diameter—Drill ⅜" Diameter**

NATIONAL ACME'S "ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION
Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Manning, Maxwell & Moore, Inc. . . . an "every day" job for Acme-Gridleys.

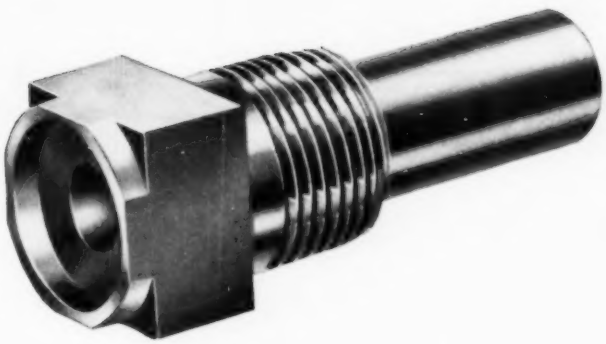
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

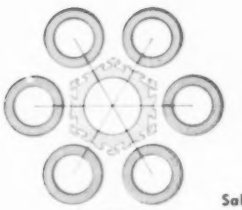


"*Cost-per-piece is substantially reduced . . .* and our increased production has enabled us to keep ahead of competition," says this manufacturer of precision industrial thermometers, gauges and valves.

"Former automatics could not keep pace with production requirements . . . many parts had to be 'farmed out', thus increasing our costs. In addition, the only downtime has been the short periods necessary for tool grinding. What's more . . . a secondary operation for deep-hole drilling was completely eliminated!"

Further benefits were realized with Acme-Gridleys' quick-change, quick-setting toolholders and wide-open tooling zones which enabled Manning, Maxwell & Moore to produce two other parts on the same machine...with only minor changes in the set-up. Add to this the extreme accuracy and flexibility of direct camming and independently operated toolslides, and you will realize why this manufacturer found his Acme-Gridleys a profitable investment.

It will pay *you* to investigate the complete story on the industry's more modern approach to cost reduction. Call, write or wire.



Pioneer in Circumferential Automation

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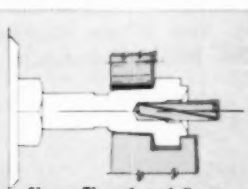
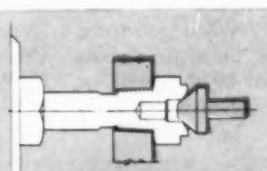
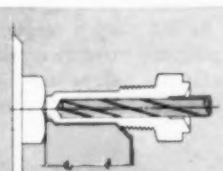


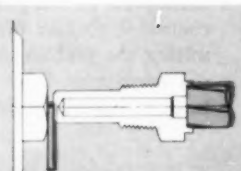
2. Shave Thread and Front Diameter—Drill 5/8" diameter partway



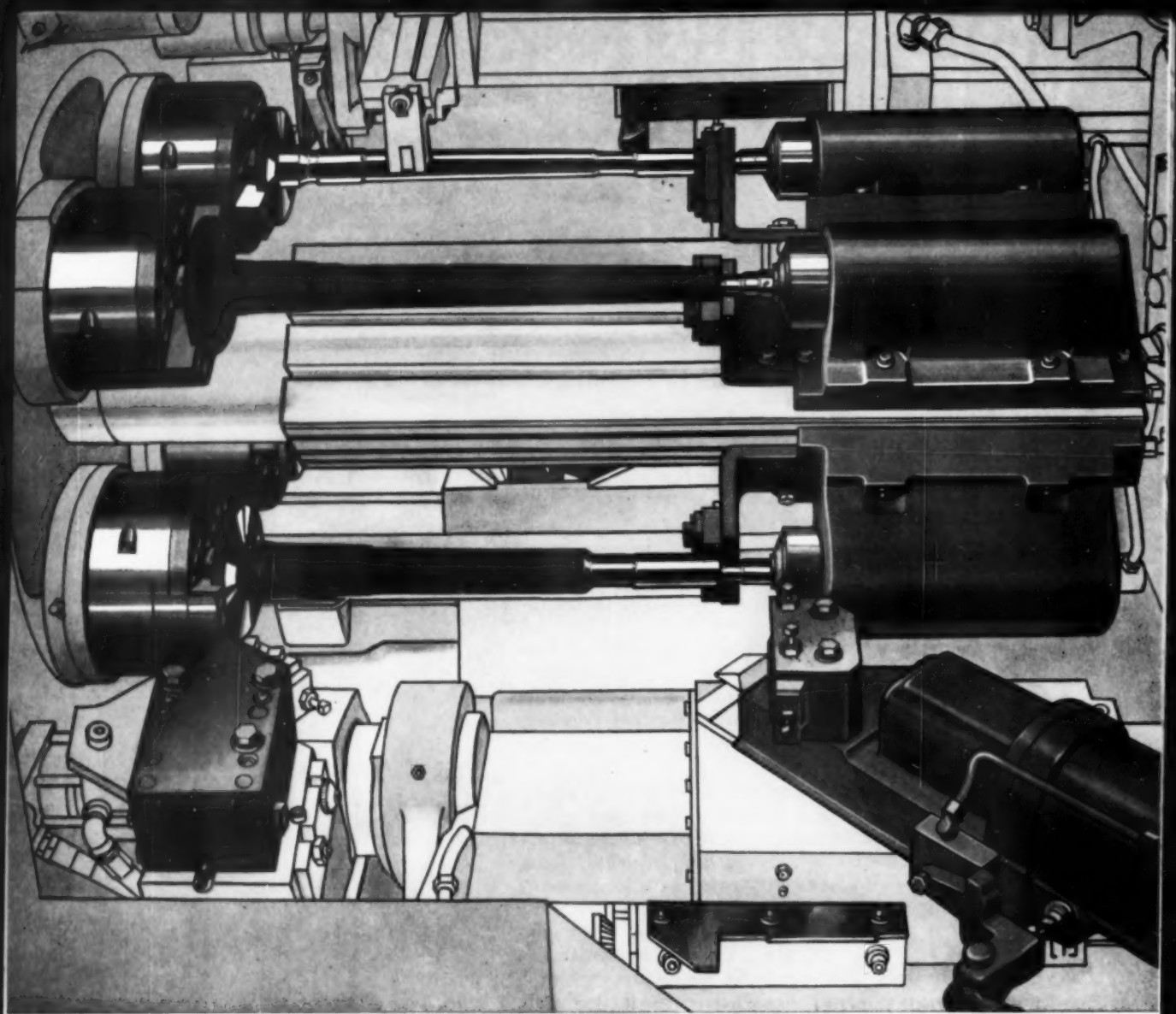
3. Roll Thread—Support



4. Finish Form Rear and Breakdown for Cutoff—Drill 1/4" diameter remainder



5. Counterbore Large Diameter —Cutoff



idea *for volume producers of shafts*

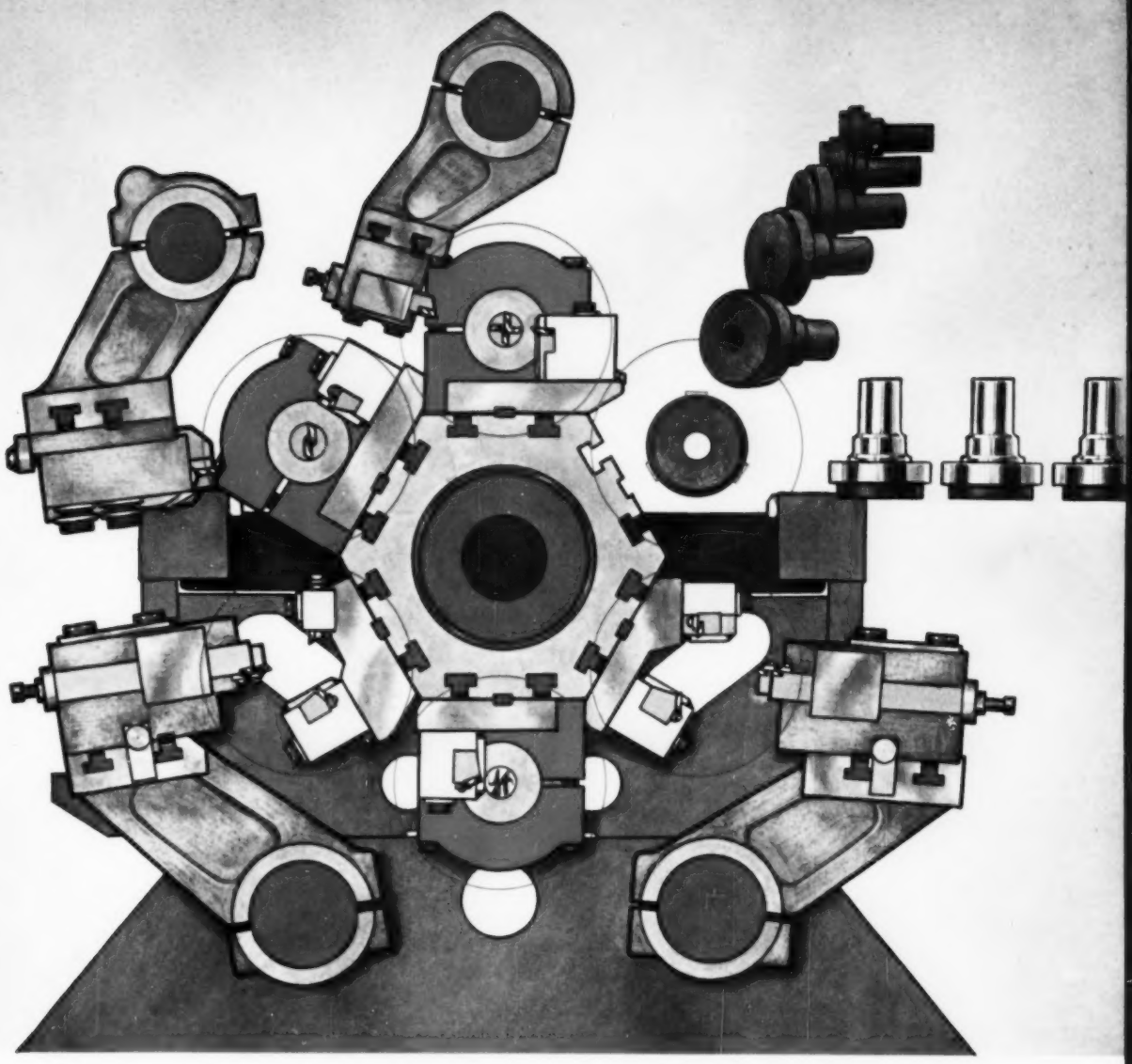
Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years – up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25—a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Set-up is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



two *approaches to the depreciation problem*

Until there is relief in the form of a more liberal tax depreciation policy, there's only one way to avoid the pinch of a shop full of over-age machines you can't afford to replace: *Buy machines that will stay new.*

If you are a user of New Britain chuckers you have seen their basic principles continue to stand as the most advanced design available, year in and year out.

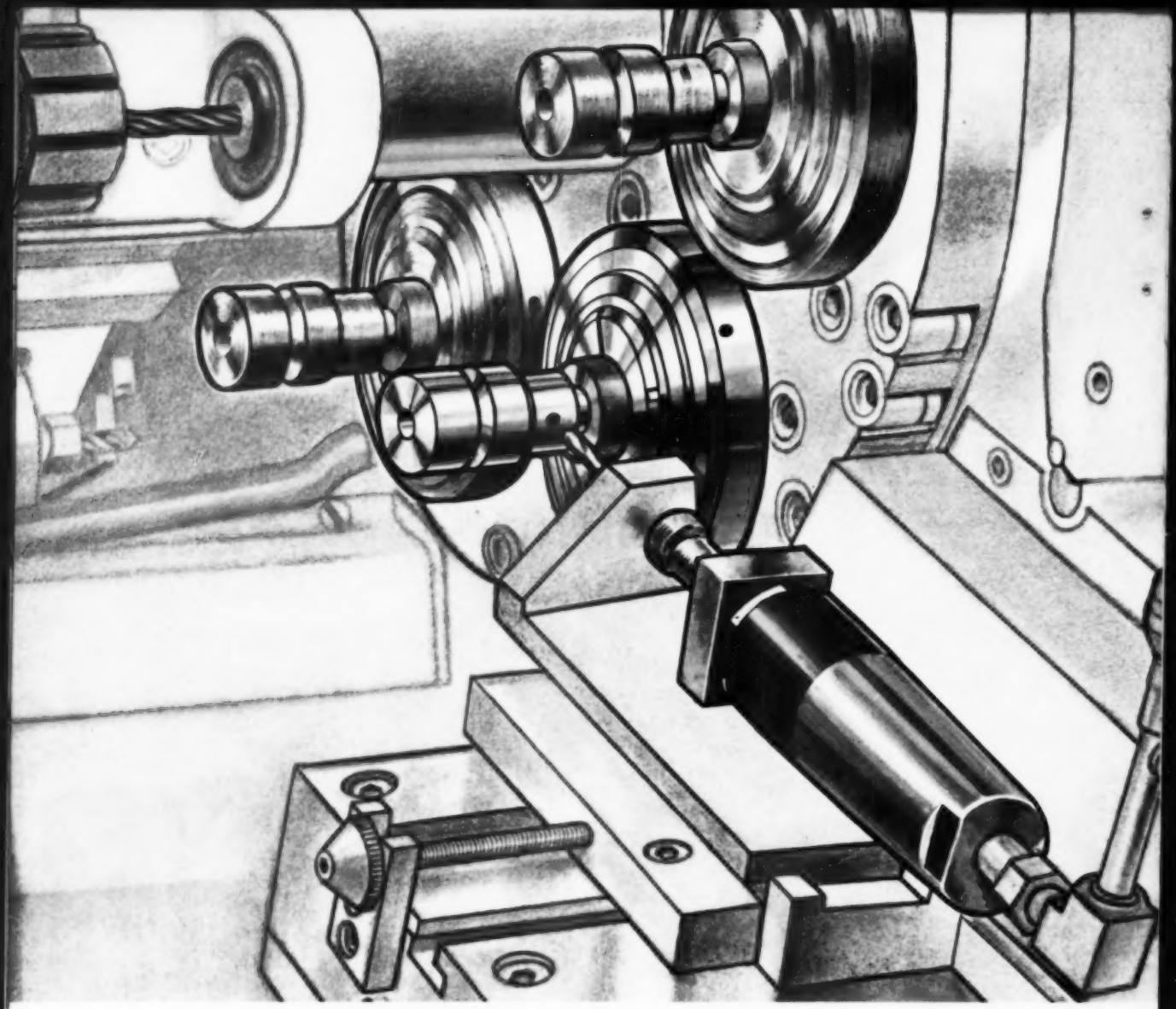
What value do you place on lifetime machine accuracy? The spindle carrier is the heart of a chucking machine. On a New Britain the carrier is lifted during index so it can't wear—then positively clamped to the frame during the cutting cycle for accurate cutting.

Interested in heavy facing and forming cuts? The long established New Britain swinging forming arm feature remains the best answer.

Want maximum clearance for fast and easy tooling, adjustment, and chip removal? Only New Britains are built with open end construction.

Today's New Britain chuckers provide the spindle speeds and power to take advantage of the most modern cutting tools. Optional tooling equipment includes drill speeders and attachments for reversing and non-reversing threading, recessing and accelerated reaming.

A new catalog describes the full New Britain line of 4-, 6- and 8-spindle, open-end, chucking machines. Fully illustrated in color, showing actual jobs, it may well suggest ideas for doing your work. Write for your copy. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



1960 productivity **now**

If you have a voice in the purchase of machine tools you have probably begun to think in terms of what will be on exhibit at next year's Machine Tool Show.

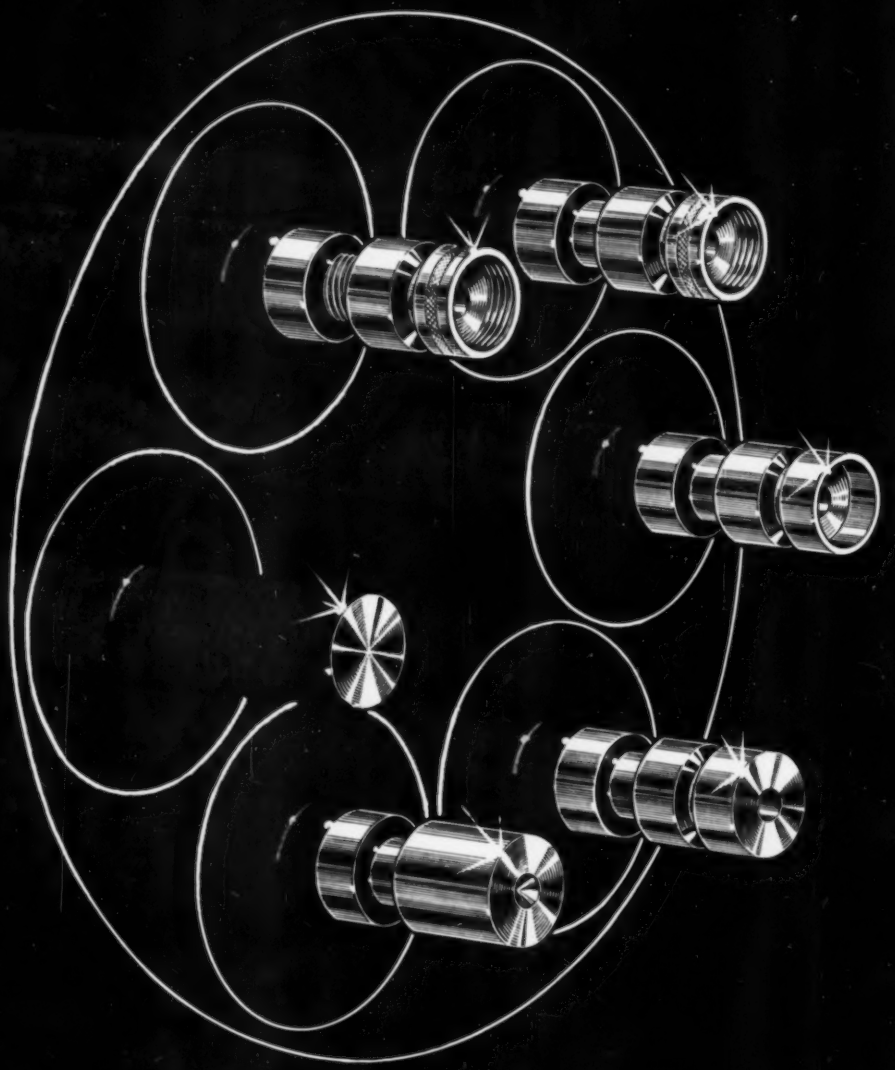
As far as multiple spindle bar work is concerned, you can see and buy and profit from the "show year" developments of New Britains a year ahead of time.

More operations, more pieces per hour, at closer tolerances has been the demand for years. Now New Britain has brought out a complete new line of bar machines that gives these words a brand new meaning.

Take the new Model 45 4-spindle series. The spindle capacity of 5" puts much larger pieces within automatic high-speed bar machine production range. Cross slides in all positions greatly increase the number and variety of cuts possible on four spindles. Spindle speeds up to 526 RPM provide for the use of the latest cutting tools. At the other extreme is a new line of 8-spindle machines. As you would expect with New Britain's radial independent cross slides, you can apply a tremendous number of tools and attachments to get very high production on really complex pieces. Or, with a double indexing set-up, you can turn out pieces, even pretty complex ones, at an all-time high rate per hour.

Six-spindle machines are everybody's work horses and New Britain offers the Model 52 in the 1¼" range, and the Model 62 with 2¼" capacity. These machines allow you to use a greater number and variety of tools on them without sacrificing accessibility. They can be tooled quickly and you can get at the tools for changes or adjustments with ease.

We can only suggest here some of the "show year improvements" in a greatly expanded line of New Britain bar machines. Your New Britain representative will be glad to arrange for a demonstration, and secure performance data based on your prints. If you would like to look over a catalog first, we'll be glad to send you complete descriptive literature. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.



3½"—More **capacity** *than ever in a New Britain*

Model 82 • Six Spindles • 3½" Capacity • All New

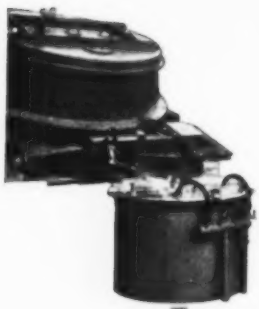
Here is a *brand new* New Britain . . . the most modern large capacity bar machine available. The Model 82 brings to the 3½" size range all the versatility and exclusive New Britain features previously available only on smaller models. Designed from the ground up for large capacity work, the Model 82 is the only 6-spindle machine on the market that offers a really up-to-date replacement for the older, slower methods currently used for this size range.

Each of the six spindles on the Model 82 has an independent, cam-operated cross slide. These cross slides combined with the end-working tool slide allow practically unlimited tooling combinations.

The Model 82, like all New Britain Bar Machines, has a special lifting and locating mechanism which prevents wear on the spindle carrier. Rigid locking of the carrier to the massive frame during the cutting cycle eliminates vibration.

The power, massiveness, speed range, accuracy, ease of changeover, coolant capacity and every other feature designed into the Model 82 makes this the right machine for high-precision, high-production, large-capacity bar work.

Why not investigate the possibilities the Model 82 offers in your plant? When you get right down to it, it's the first chance you've had in a long time to update production in an area that needs it badly. Complete catalog material is available on the whole range of New Britain Six Spindle Bar Machines. For your copy, write to The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.



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Non-Ferrous Melting

LEADERS IN

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THE ONLY SINGLE

60 Cycle
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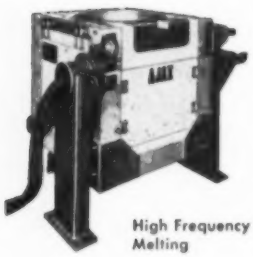

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- 60 CYCLE CORELESS FURNACES
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- DUAL AND HIGH FREQUENCY FORGE HEATERS
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- HIGH FREQUENCY MELTING FURNACES
- SPARK GAP CONVERTERS

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specializing in high frequency melting equipment and spark gap converters.

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specializing in billet heating for extrusion and forging, heat treating and annealing in frequencies from 60 cycle to 450 KC.

TO MEN OF INDUSTRY

THIS IS OUR ANSWER TO INDUSTRY'S NEED FOR A FULLY INTEGRATED INDUCTION HEATING COMPANY. EACH COMPANY IS A LEADER IN ITS OWN SPECIALTY OF THE INDUCTION HEATING FIELD.

WE'VE JOINED TO MAKE A COMPLETE LINE OF INDUCTION HEATING PRODUCTS AVAILABLE FROM ONE SOURCE—TO PROVIDE AN AGGRESSIVE RESEARCH PROGRAM THAT WILL MEAN NEW AND BETTER PRODUCTS—TO ENABLE US TO SERVE INDUSTRY BETTER WITH A DECENTRALIZED SALES AND SERVICE ORGANIZATION OF MEN WHO ARE EXPERTS IN THEIR FIELD.

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PRESIDENT

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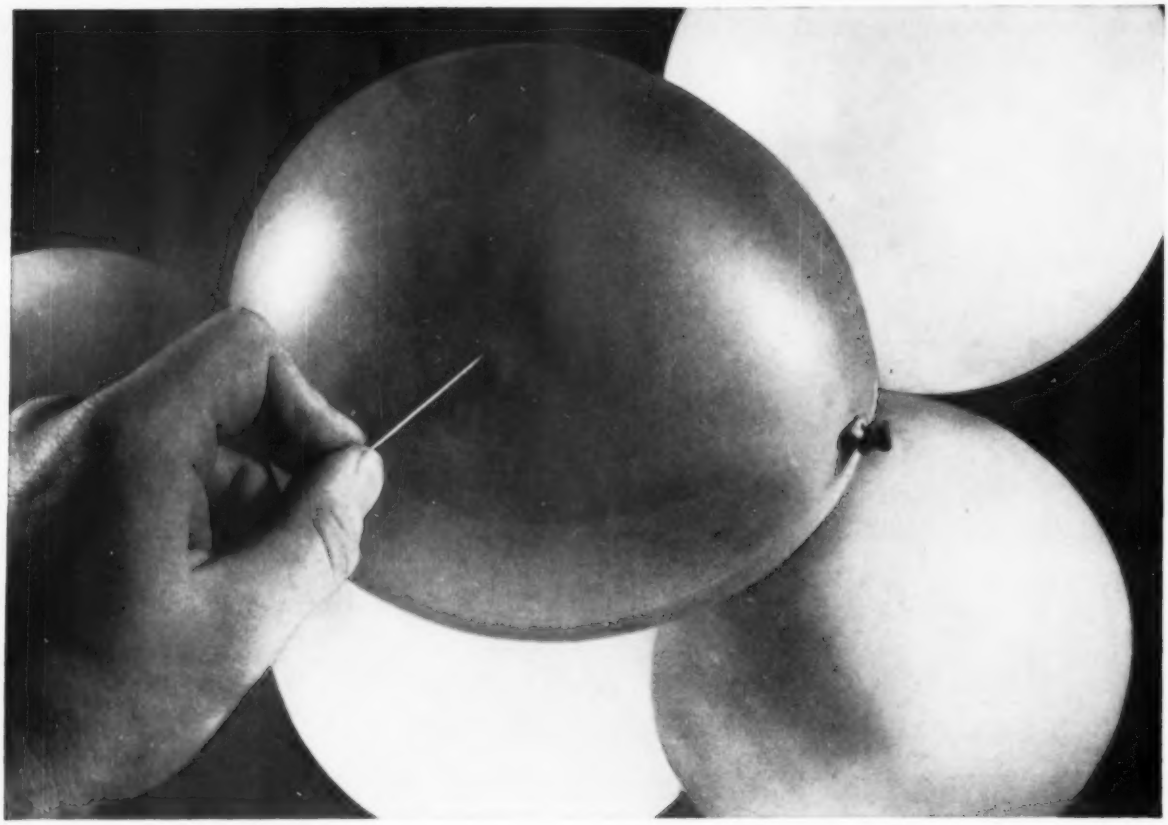


Machine Tool Buyers:

Beware the fallacy of projecting today's labor rates!

Almost without exception, machine tool replacement formulas employ an erroneous factor in computing savings — they are based on *today's* labor rates.

It seems basically sound to suggest, in the case of a contemplated investment in equipment, that a projection be made as to the estimated period over which the equipment is to be used.

Assuming this to be ten years, it is a fairly simple matter to project the *average* wage rate over the next ten years by using the historical increase for the past several years. This increase is known to be from 5 to 6% per year.

Using 5%, we then have a simple computation to determine the average projected wage rate which should be used in computing savings in a replacement formula.

Assuming a current wage rate of $2.50 per hour, this becomes $4.07 per hour at the end of ten years, or an increase of 62.8% over today's labor rate.

This percentage increase could reasonably be applied also to other factors in the computation of savings, such as indirect labor, fringe benefits, maintenance, etc.

In contemplating the purchase of a piece of equipment which will last for a number of years, it is fallacious, therefore, to compute savings in terms of today's costs only.

Does Jones & Lamson offer a positive approach; a realistic, workable formula that is free from fallacies such as this? *Yes!*

Write today for complete information.

the man who needs
a new machine tool
is already paying for it

JONES & LAMSON Machine Company, 502 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

CIRCLE 220 READER SERVICE CARD

CIRCLE 221 READER SERVICE CARD ►

Man-made diamonds add the newest "Touch of Gold" value to carbide grinding

In carbide grinding the product-improving, cost-cutting "Touch of Gold," created by Norton leadership in diamond wheel development, began back in 1930. Today, man-made diamonds are adding something new to the "Touch of Gold." Their use as abrasives is steadily increasing, because of their improved performance and economy.

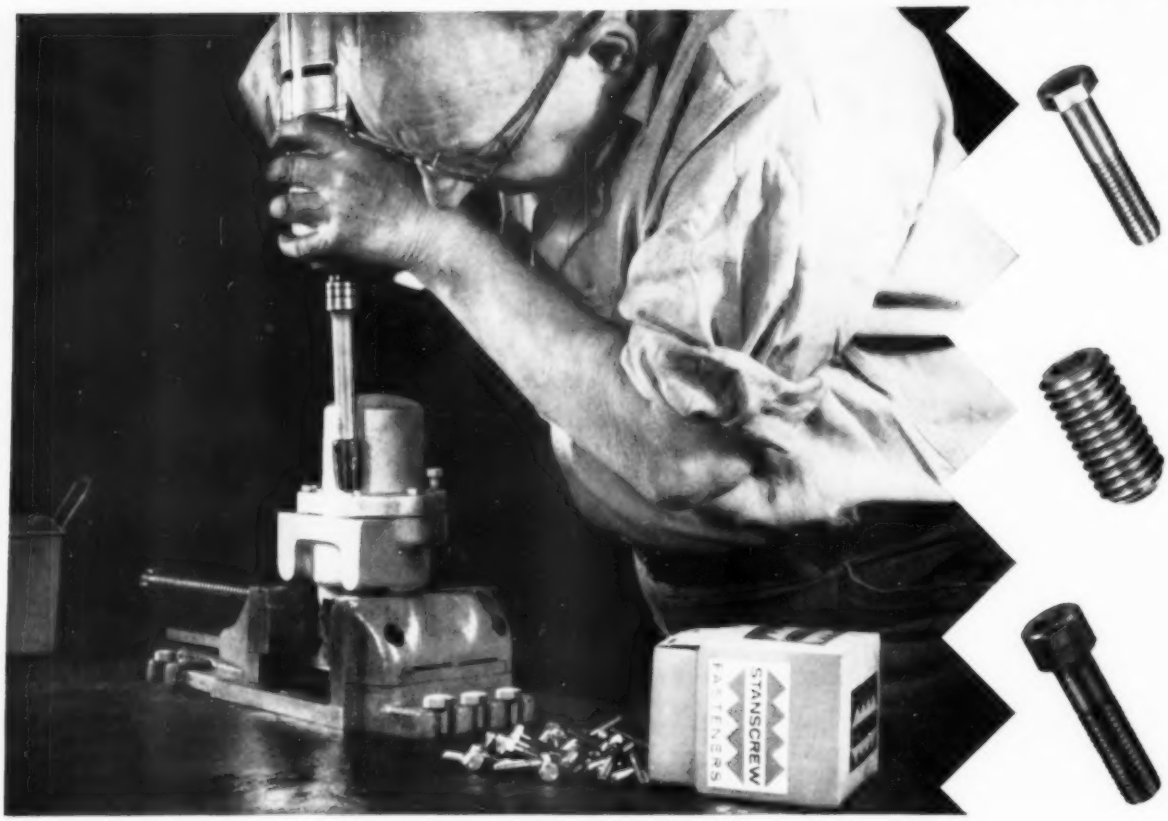
Norton was first to introduce all three bond types of diamond wheels . . . manufactures with complete uniformity of specification . . . produces the largest line . . . and *certifies* the diamond content of each wheel. Today, similar pioneering continues Norton leadership in the use of man-made diamonds . . . bringing you better performance, longer service life and lower grinding cost for every dollar you spend. NORTON COMPANY, Worcester 6, Massachusetts.

NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

IT PAYS TO STANDARDIZE ON **STANSCREW**



Stanscrew service cuts rejects, speeds assembly for valve manufacturer

A prominent manufacturer of 4-way valves for freon was having trouble on his assembly line. His fasteners, tightened to an extreme degree to prevent seepage of the gas, were breaking on too many occasions. This meant complications in assembly and a high reject rate—which increased production costs substantially.

One of Stanscrew's fastener specialists, called in by a Stanscrew distributor, quickly found the answer. He recommended a standard cap screw and had staff engineers work out the precise torque which should be applied to insure a complete seal at all gaskets, yet eliminate any possibility of fastener breakage. By following these recommendations, the manufacturer has eliminated the problem of fastener breakage, and substantially reduced his reject rate.

Stanscrew offers over 4,000 standard fasteners . . . including a complete selection of socket, set, and cap screws. All are produced under rigid quality control methods and incorporate the lessons learned during 85 years of fastener manufacture. All 4,000 are always in stock and quickly available.

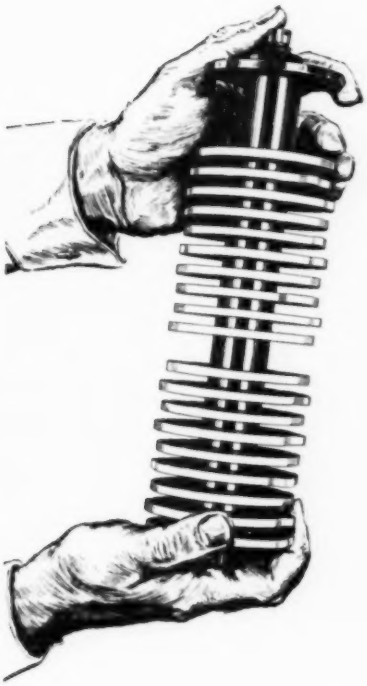
For the answer to your fastener problem, call your Stanscrew distributor. He will have a Stanscrew fastener specialist promptly study your operation and make specific recommendations.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

He's **holding** an automatic cycle



Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle lathe available today.

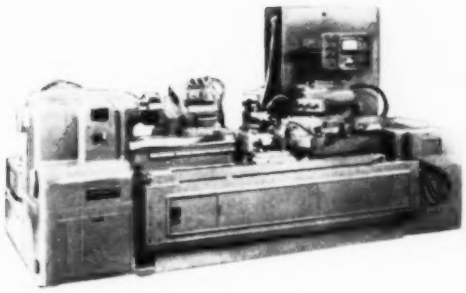
You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to fully realize the economies inherent in ceramic tooling.

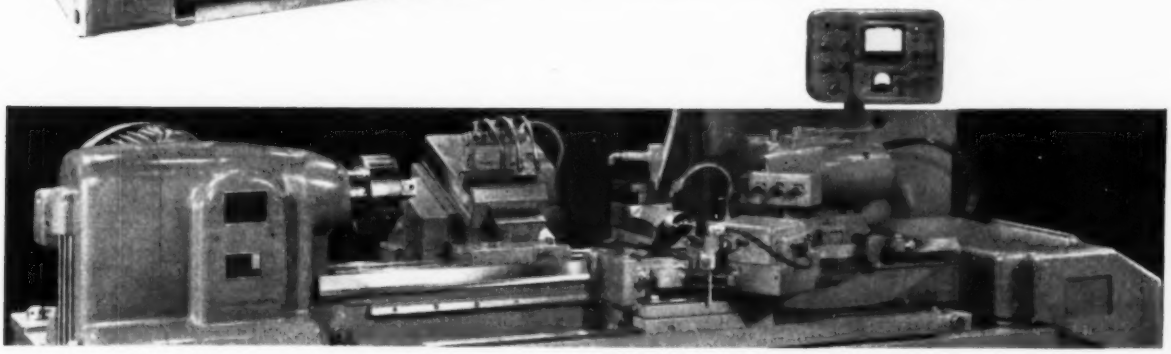
This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing multi-cycle programmer and making a few quick readjustments.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known. It's so fast in operation that the only limitation in cycle speed is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail... **The Monarch Machine Tool Co., Sidney, Ohio.**



- Exclusive automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle.
- All feeds adjustable under cut. This often lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control with a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within ±.001" on most jobs.
- All way surfaces flame hardened and ground. The accuracy built in is retained year after year.
- Work piece change speeded by a single multiple position lever on tailstock. In proper sequence it controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.



Flexibility Unlimited

With such optional equipment as (1) inbuilt constant surface cutting speed, (2) automatic indexing two-position tool holder, (3) power chip conveyor and (4) chip and coolant guard.

Monarch
TURNING MACHINES
FOR A BETTER TURN FASTER... TURN TO MONARCH

ACCURACY

When You Buy from Your Local P&W Cutting Tool Specialist

The men you'll do business with are experienced, factory-trained cutting tool specialists . . . not just "order-takers." Their expert advice will insure the right tools to do your jobs faster and better. You'll be sure to get the biggest return on every dollar spent, because P&W Cutting Tools are QUALITY from start to finish — last longer and produce more, accurately finished pieces.

Expert engineering service, quality, dependability, and availability are all yours for the asking at any one of these P&W Branch Offices. Why not phone or call today?

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FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

ASSURED...

COSTS REDUCED WHEN YOU BUY PRATT & WHITNEY TAPS

These Pratt & Whitney taps produce more accurately threaded holes per tool, because they ARE accurate . . . with squares, shanks, threads, OD's, and chamfers all precision machined and ground on centers.

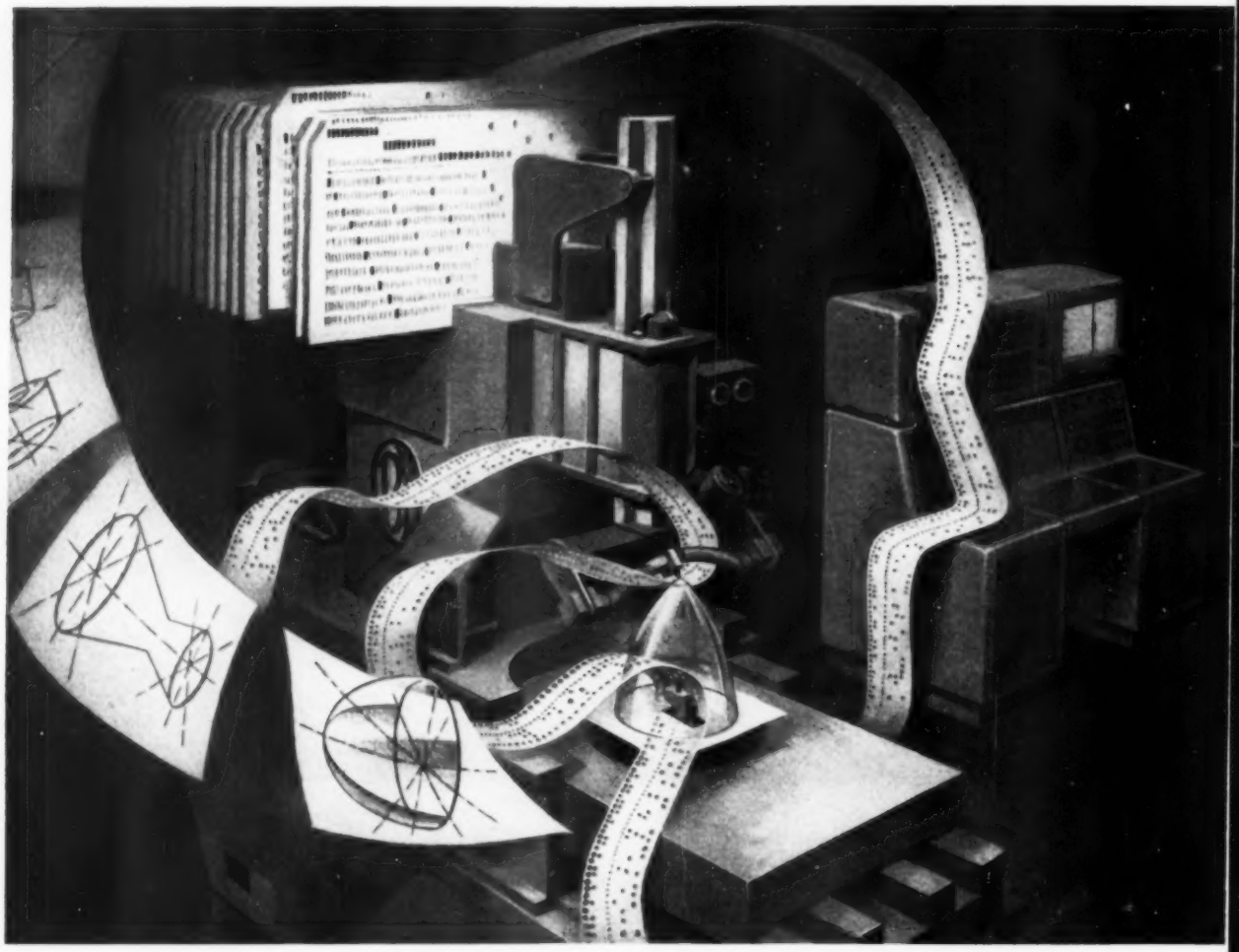
Whether it's taps or other cutting tools, you'll save time and money when you buy from your local Pratt & Whitney Branch Office. You can be sure that all P&W Cutting Tools are *quality* from start to finish . . . cost you less in the long run, because they run far longer before replacing or re-grinding. Equally important, you'll be doing business with men who are experienced, factory-trained cutting tool specialists. You can always count on their expert advice to help you pick the best tools for your specific requirements.

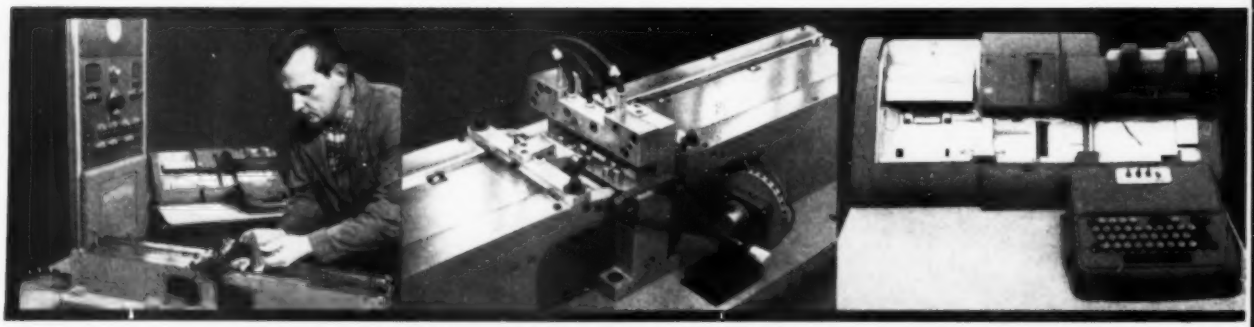
YOUR ANNUAL INVESTMENT IN CUTTING TOOLS ADDS UP TO A LOT OF MONEY . . .

so phone your nearby P&W Branch Office today and ask a P&W Specialist to show you how to reduce your cutting tool costs. Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Conn.

TAPS • THREAD ROLLING DIES • THREAD MILLING CUTTERS • MILLING CUTTERS • END MILLS • REAMERS • KELLERFLEX BURS • KELLER CUTTERS

ACCURACY





405 SEPARATE MEASUREMENTS ARE CHECKED AND DATA PROCESSED . . . by this Pratt & Whitney Gage with "Data-Limit" digital readout. The workpiece is a precision part for a nuclear reactor. In operation, a cross section is gaged at 9 separate points, the piece moves forward a pre-determined distance, and the multi-dimensional check is repeated. In all, 45 cross sections—involving 405 separate dimensions—are checked. Digitized data readout is used to "remember" individual measurements, compute the average cross section and, finally, to print on an IBM card a complete visual record of all dimensions and computations. Except for placing the workpiece in the gaging member, operation is completely automatic.

ASSURED...

NEW "DATA-LIMIT" GAGING CONCEPTS CAN SMASH YOUR MULTI-INSPECTION BOTTLENECKS and REVOLUTIONIZE YOUR QUALITY CONTROL METHODS

Applying the techniques of numerical control and digital readout to inspection operations, Pratt & Whitney offers DATA-LIMIT . . . a new concept in gaging. This new development can help you speed up multi-dimension inspection for complicated parts to keep pace with the increased output of automated production machines. It can "remember" or process gage data . . . instantly compute tapers, fits, wall thicknesses or other dimensional interrelationships . . . control automatic sorting or classifying for selective assembly . . . or provide a complete quality control record using any desired type of printed form.

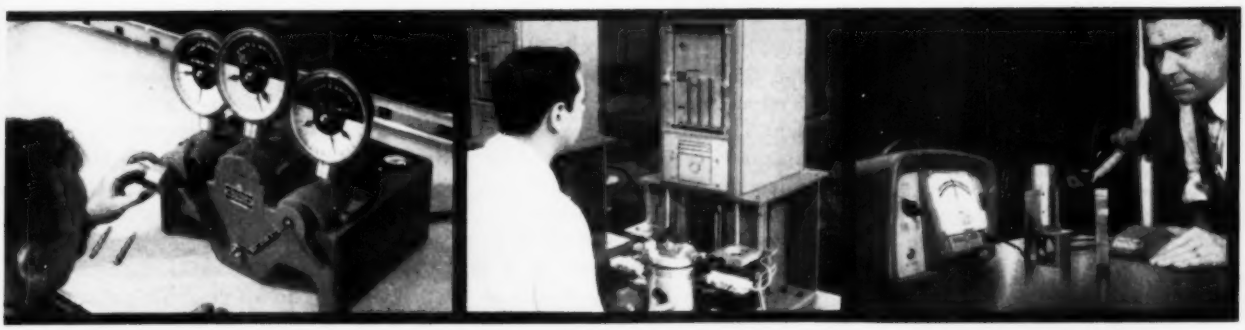
For example, numerically controlled P&W Measuring Machines, with information supplied by punched tape, automatically check hundreds of coordinate points on inner or outer surfaces of complex parts . . . including missile shapes and similar components. Digital readout systems applied to these measuring machines, and to other P&W Gages, are helping manufacturers speed gaging, reduce inspection costs, eliminate human errors, reduce inventories where selective assembly is required, and improve product precision and performance by providing more complete records of dimensional data.

To eliminate gage bottlenecks and insure continued progress and profit, your inspection methods must advance with your production equipment . . . and this calls for Pratt & Whitney's DATA-LIMIT . . . the new concept that applies modern numerical and digital techniques to gaging. If more complete dimensional information about your components . . . and faster processing of this data . . . can help you streamline inspection procedures, Pratt & Whitney can engineer a complete system to do the job. For more complete information, write for your copy of Circular No. 627. Better still, make arrangements now to have a P&W Gage Team visit your plant, analyze your needs, and recommend a truly modern inspection system. Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Conn.

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

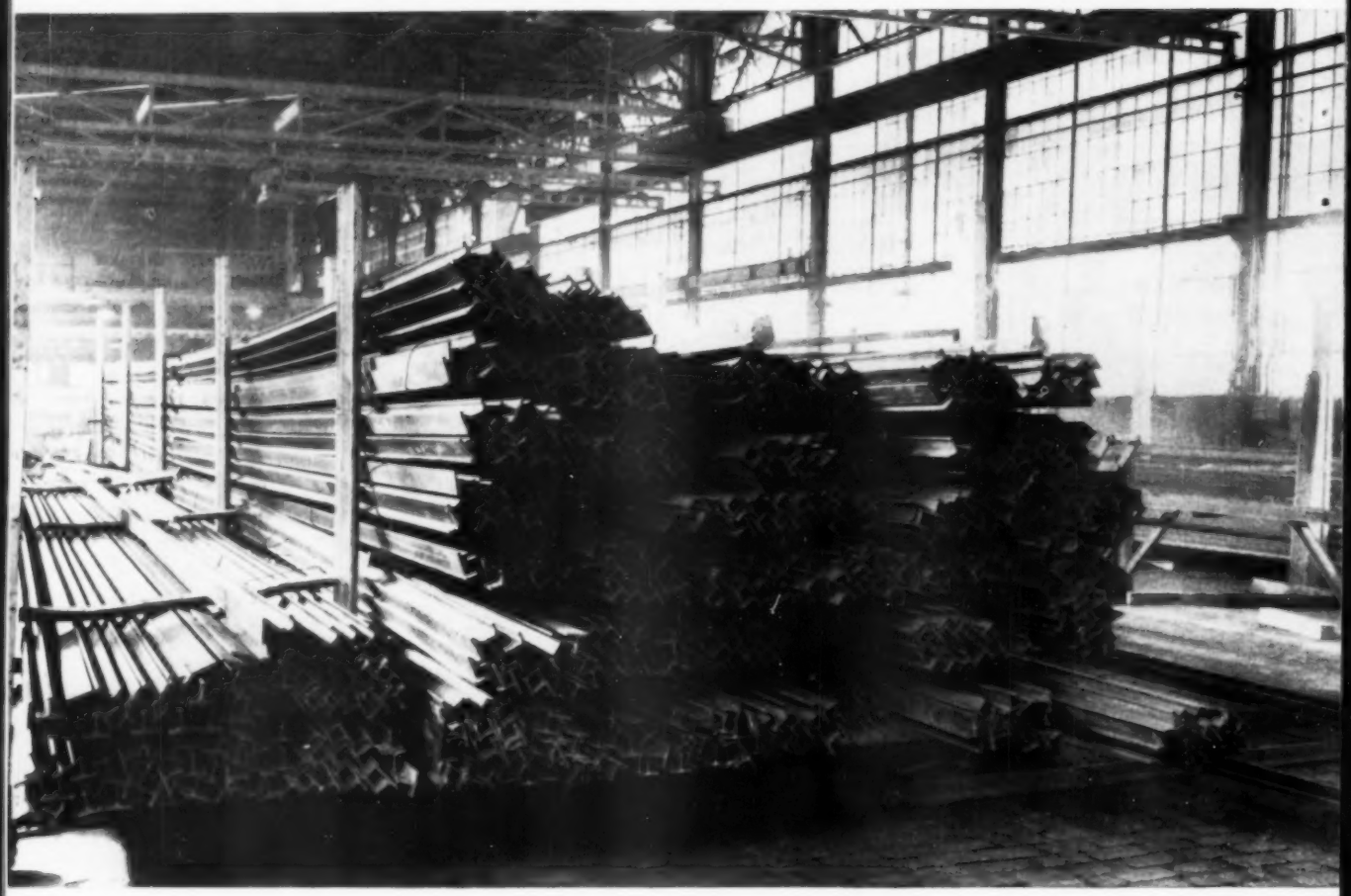


AIR-O-LIMIT COMPARATORS . . . are one of the many P&W gaging methods available to you. Unusually versatile, these gages are easily adapted to check an unlimited variety of parts with speed and accuracy.

P&W SIGMATIC MULTI-GAGING MACHINES . . . help break gaging bottlenecks by simultaneously checking up to 50 dimensions with speed and accuracy. Interchangeable gage tooling permits fast, easy change-over.

P&W TRANS-O-LIMIT COMPARATORS . . . offer outstanding circuit stability, extreme versatility, and gaging pressures less than 1 ounce. Reads in thousandths, ten-thousandths and millionths.

STEEL SHAPED TO CUT COSTS AND IMPROVE PRODUCTS



A one-piece rail rolled for the runway of Cleveland Tramrail Systems. This track has flat raised treads designed to minimize peening. No machining is required on this USS Special Section.

USS

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

United States Steel

Tramrail—non-peening, no machining made from USS Special Sections

This supply of rails for Cleveland Tramrail Systems represents a cost saving running into many thousands of dollars. They are USS Special Sections rolled to exact size and cut to proper length. If the rails had to be machined from bars of high-carbon or alloy steel, the cost would be prohibitive and scrap losses tremendous.

The steel is furnished in a high carbon grade which serves to minimize track wear caused by wheel peening on the track tread. The manufacturer says that in 30 years no other overhead track has been offered that surpasses this one for durability.

It's seldom that better products can be produced at substantially lower costs but that's what happens when you use rolled USS Special Sections. Rolled to the predominating cross section needed, it is a custom-tailored part, designed and rolled so that there is little or no finishing required to meet final specifications.

Why not find out what USS Special Sections can do for you? This is one *sure* way you can help to keep costs down and get faster production at the same time.

Write for our new book, USS Special Sections. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

MISSILE MANUFACTURER

63% savings in time . . .

SPECIAL EQUIPMENT MA

Outprod

SUBCO

Excell

ICEMAKI

$25.92 p

FOUNDRY EQUIPMENT MAKER

Above $4000 yearly savings...

excellent accuracy, duplicating to less than .001". . . clean front and ease of conversion to regular or Copymatic operation are outstanding . . . removing 15 to 30% more metal than our best (lathes) — twice that of some.

MACHINE TOOL BUILDER

82% time saved . . .

MACHINING SUBCONTRACTOR

Saving up

EQUIP

Out

TOO

82%

AIRCRAFT SUBCONTRACTOR

Helps make deliveries and money..

NOTED BOAT BUILDER

$2000 annual saving . . .

ELECTRONICS MANUFACTURER

Production increased 200%

Shown is 90° COPYMATIC Lathe with 4-Way Power Rapid Traverse, (optional extra). 45° COPYMATIC and Powershift Preselector headstock also available.

HOW TO JUSTIFY YOUR LATHE REPLACEMENT

LOOK AT LODGE & SHIPLEY FIRST!

More production at lower cost is the answer to constant upward pressure on prices. Savings proved in Lodge & Shipley case histories* show the wisdom of investigating *and* buying a Lodge & Shipley POWERTURN Lathe as a profitable replacement.

Production requirements change. The lathe purchased just a short time ago may not be adequate . . . judged by today's production, accuracy and economic standards. Details in Sweet's Machine Tool File; contact local representative through Yellow Pages or write direct for case histories and Bulletin No. L-103:

The Lodge & Shipley Co., 3056 Colerain Avenue, Cincinnati 25, Ohio.

**Names and details on request.*

Lodge & Shipley

This is a MARVEL High-Speed-Edge Hack Saw Blade Cutting a 4" x 4" Titanium Billet

EVERYTHING'S IMPROVED BUT THE GUARANTEE

33 years ago, MARVEL introduced the first welded-edge hack saw blades . . . guaranteed them to be shatterproof . . . and a new concept of power hack sawing came into existence.

In combining, by welding, two materials—a narrow, high speed steel cutting edge, and a tough alloy steel body, MARVEL pioneered the modern hack saw blade.

When operators learned they could apply the heaviest feed pressures and highest speeds to the new MARVEL Blades with complete confidence that they would never shatter or "explode" to cause them personal injury, hack sawing began the approach to its present high level of efficiency. Even cutting "exotic" metals, such as titanium, where heavier feed pressures are a necessity, the MARVEL Blade does an outstanding job and is completely safe.

Today's MARVEL High-Speed-Edge Hack Saw Blades are greatly improved, even over the MARVEL Blades which were the best on the market a few years ago. Advanced metallurgy has produced better steels; new heat treating and manufacturing techniques have brought further improvements. The only thing unchanged is the Guarantee: THEY ARE SHATTERPROOF!

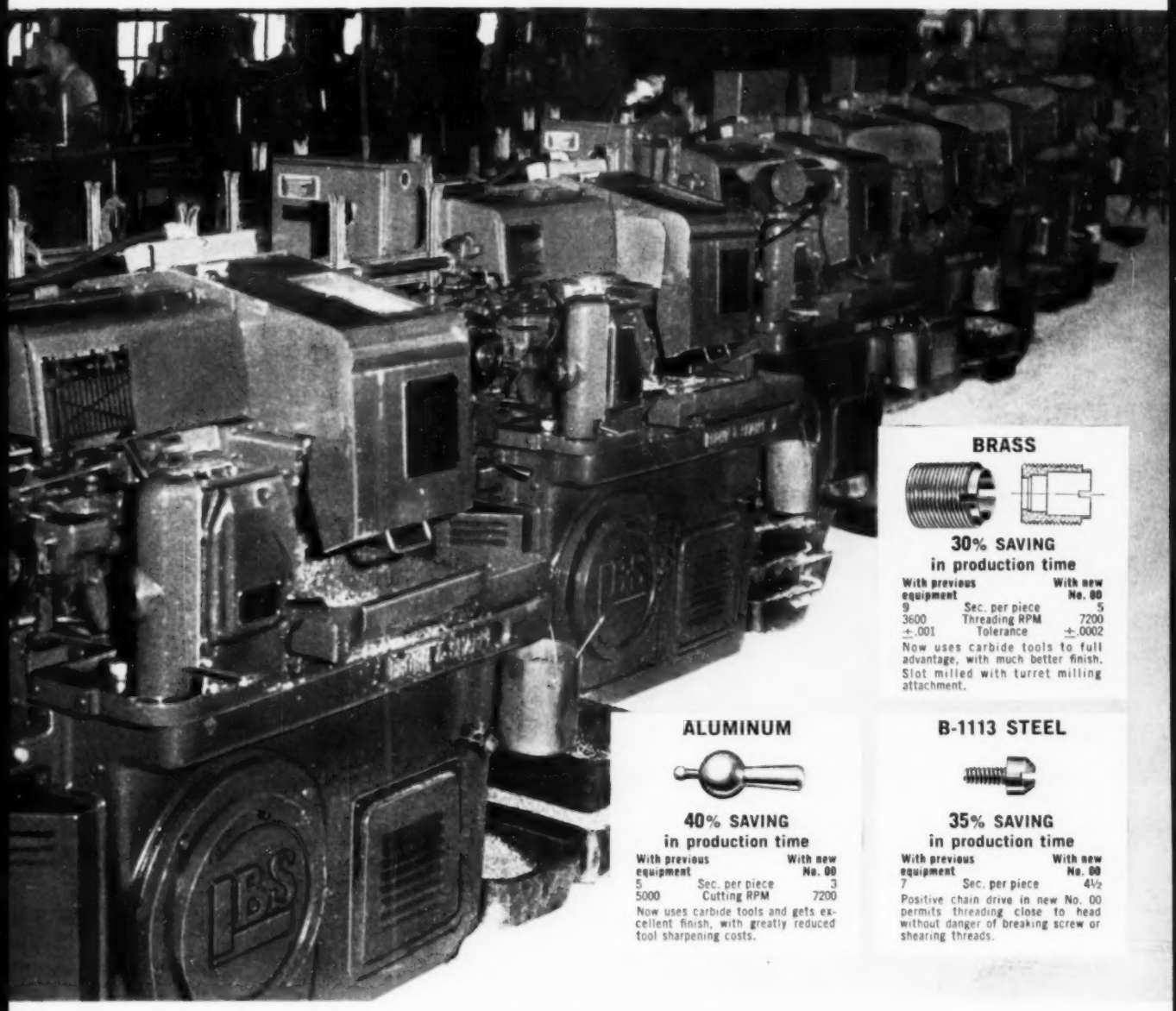
If you haven't used MARVEL High-Speed-Edge Hack Saw Blades recently, try them on your saws for a month and see the difference a truly superior blade can mean in higher speeds, greater accuracy, lower cost per cut, and guaranteed safety to operating personnel. Your nearby MARVEL Distributor carries a complete stock of MARVEL High-Speed-Edge Blades.

Write for Bulletin CT-175 which has complete details on MARVEL High-Speed-Edge Hack Saw Blades.

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

Metal Cutting
MARVEL SAWS
Better Machines—Better Blades

At ARROW (AH) HART



BRASS

30% SAVING
in production time

With previous equipment		With new No. 00
9	Sec. per piece	5
3600	Threading RPM	7200
±.001	Tolerance	±.0002

Now uses carbide tools to full advantage, with much better finish. Slot milled with turret milling attachment.

ALUMINUM

40% SAVING
in production time

With previous equipment		With new No. 00
5	Sec. per piece	3
5000	Cutting RPM	7200

Now uses carbide tools and gets excellent finish, with greatly reduced tool sharpening costs.

B-1113 STEEL

35% SAVING
in production time

With previous equipment		With new No. 00
7	Sec. per piece	4½

Positive chain drive in new No. 00 permits threading close to head without danger of breaking screw or shearing threads.

Production gains average 35%

with new Brown & Sharpe Automatics

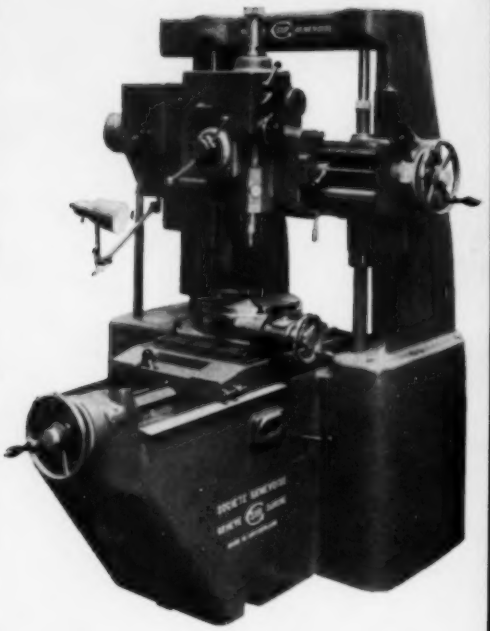
Arrow-Hart and Hegeman Co. depends on screw machines for an exceptional volume and variety of parts used in their big line of electrical products. Production efficiency of this department is a vital factor in cost control. That is why nineteen new Brown & Sharpe No. 00 and No. 2 automatics are now in operation, and more are being installed as old model machines are replaced.

The parts described are typical of hundreds of jobs now running on the new No. 00 automatics. Production gains on brass, steel, and aluminum average 35%, and on some jobs where second operations were eliminated, net production was increased as much as 100%.

Figure the comparable savings you can make with the extra speed and precision — the adaptability for combined operations — the faster set-ups and extended tool life. You'll see why so many buyers say, "*They pay for themselves, in record time.*" For complete details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER

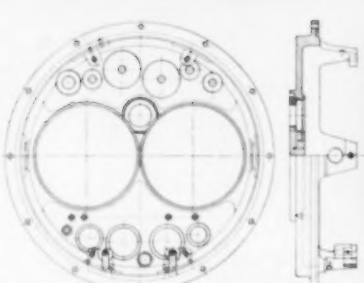
CIRCLE 231 READER SERVICE CARD

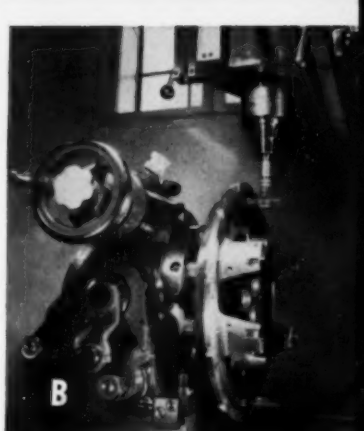


SIP No. 3K JIG BORING MACHINE
Send for Catalog 1173

Illustrated is the machining of a magnesium casting for an electronic unit . . . (A) drilling, boring and counterboring 37 holes, 62 diameters ranging from 0.255″ to 5.125″ . . . (B) drilling, boring and counterboring 11 holes, 16 diameters ranging from 0.100″ to 0.787″. Here's the record:

MACHINING TIME (A).....8 HOURS, 15 MINUTES
MACHINING TIME (B).....2 HOURS, 0 MINUTES





How's that for Production!

The machine that does it is the SIP No. 3K Jig Boring Machine. It has what it takes—ease of operation, increased generous range and capacity, plus the basic Precision that is SIP—to finish critically sensitive jobs like this so fast and so well! SIP quality and precision cost you no more.

and how's this for
Accuracy?

HOLE DIAMETERS HELD TO
+0.0004", −0
CENTER DISTANCES HELD TO
+0.00025", −0

SIP *makes Precision Production Practical & Profitable*

AMERICAN SIP CORPORATION
100 EAST 42nd STREET, NEW YORK 17, N. Y.

Since 1926 all SIP Machines delivered to U.S.A. and Canada have been calibrated in the INTERNATIONAL INCH (1″ = 25.4 mm).

CIRCLE 232 READER SERVICE CARD

HARDINGE
ELMIRA, N.Y.

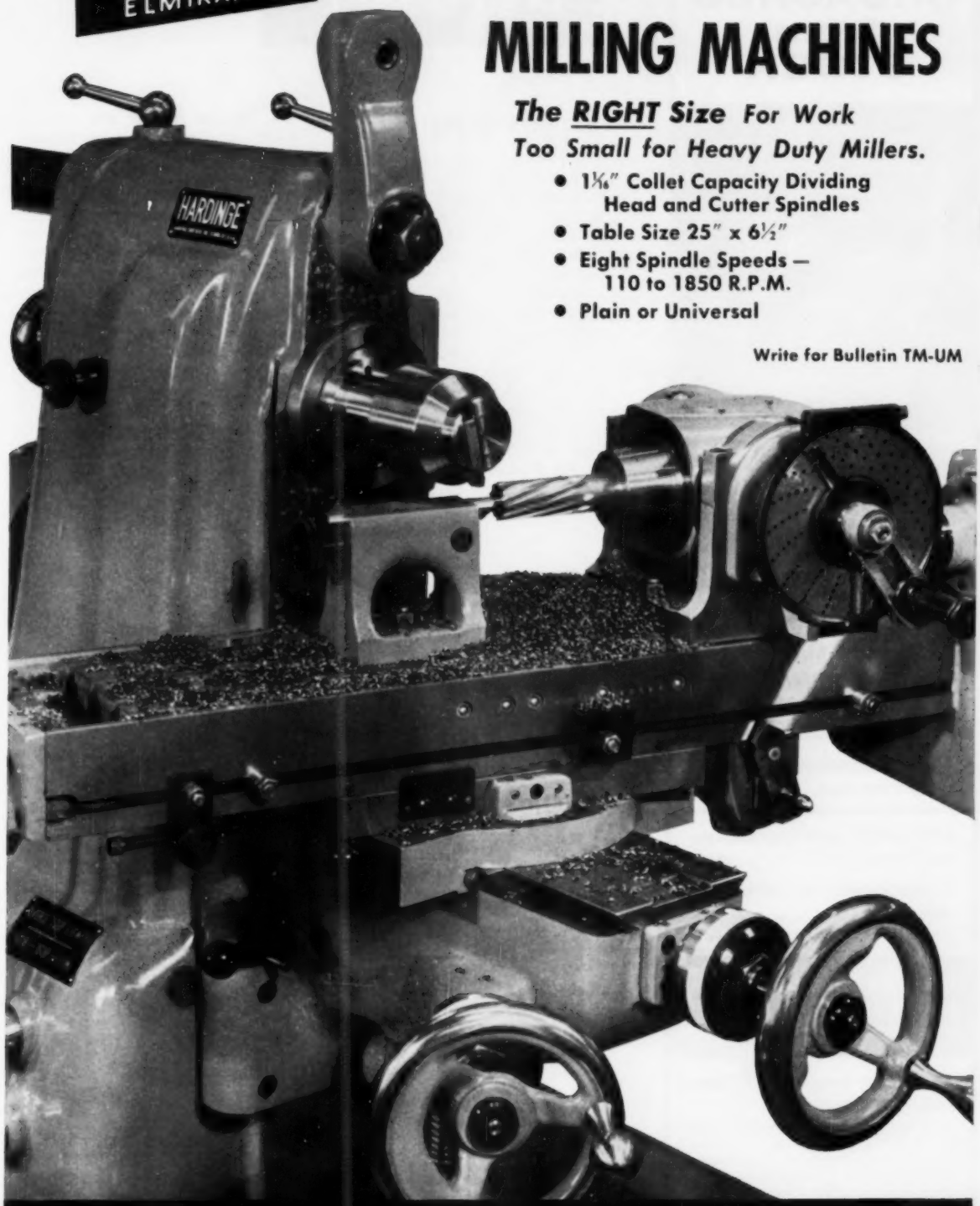
High Speed Precision

MILLING MACHINES

The RIGHT Size For Work
Too Small for Heavy Duty Millers.

- 1⅛" Collet Capacity Dividing Head and Cutter Spindles
- Table Size 25" x 6½"
- Eight Spindle Speeds — 110 to 1850 R.P.M.
- Plain or Universal

Write for Bulletin TM-UM



HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. EXPORT OFFICE 269 LAFAYETTE ST., NEW YORK 12, N. Y.

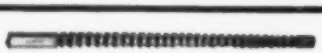
STANDARD BROACHES from STOCK

Minute Man
KEYWAY BROACH KIT

In one minute and for as little as one cent you can cut a keyway with the Minute Man Keyway Broach Kit. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME AND MONEY WITH THESE OTHER STANDARD STOCK BROACHES

SQUARE BROACHES — 1/8" to 3/4" holes



HEXAGON BROACHES — 1/8" to 3/4" holes

ROUND BROACHES — 1/4" to 1" holes

SEND FOR CATALOG AND PRICE LIST

The duMont Corp.
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST **A** describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

duMont

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Who pays for depreciation

Dear Sirs:
Will you please give us some information regarding tax savings through depreciation of plant and equipment?

How does depreciation, "recover the cost of plant and equipment," as we see mentioned so often?

Example: Suppose a plant and machinery cost $50,000 and will be depreciated in 5 years, or $10,000 per year. Then $10,000 can be deducted each year from income. Suppose the Federal Income Tax is 25%; then the tax saving per year is $2500. At this rate, how would $50,000 be recovered in 5 years, as $2500 times 5 is only $12,500?

Lloyd Barrick
Brazil, Ind

Reader Barrick's point is well-taken, and we suspect others have wondered about this mixup. The problem arises when tax savings are spoken of in the same breath with recovery of capital investment.

The important point here is that you do ***not*** *recover the cost of your machine* ***from the Government.*** *You recover it only by setting aside a depreciation reserve out of your gross income.*

There is no income tax on the amount you set aside, because the Government admits this is not profit. You are only maintaining the level of your original investment by substituting cash for the loss in value of your machine.

Depreciation is not just a gimmick for reducing your taxes. But, it does let you save up, with tax-free money, for the purchase of machines that will keep your plant up-to-date and competitive—Ed.

Challenge accepted

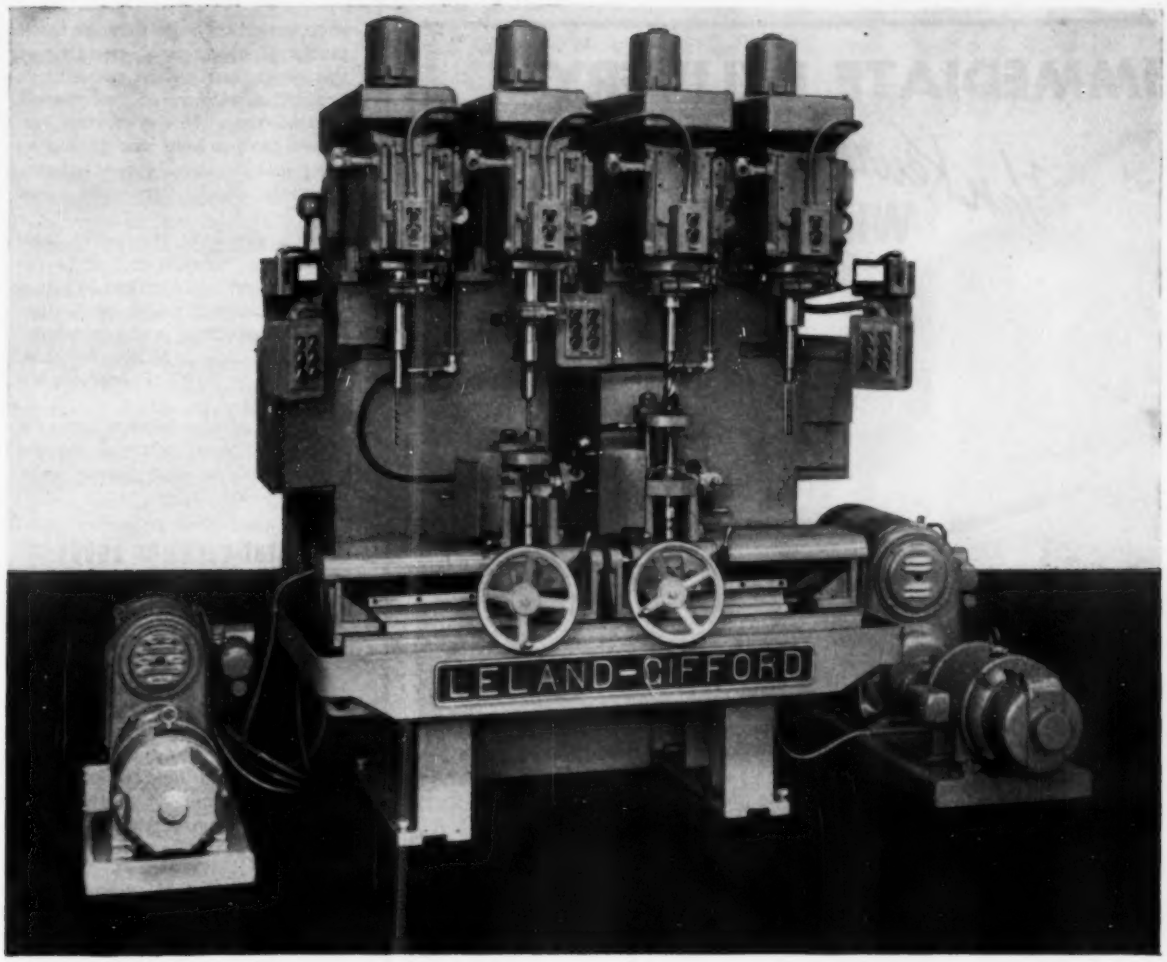
Dear Sirs:
You published a letter titled "Here's a Challenge" from a party who has had much difficulty obtaining a flat-bottomed hole, 1/16 in. in dia, one in. long, in a piece of stainless steel (*AM*—Mar 23 '59, p98).

Drilling small, round, straight,

SHOPMATES

N. Jarvis

KEEP OUT
SECRET
RESTRICTED AREA DO NOT ENTER
SURE WE FEELS BAD!!--NO BODY EVER GETS TO SEE HIS WORK.... THEY TAKE IT OUT OF HERE UNDER ARMED GUARD AN' THE NEXT THING IT'S ZOOMIN' THROUGH SPACE AT 18,000 MILES AN HOUR!!
N. JARVIS



Designed for maximum utilization —

It goes without saying that Leland-Gifford special drilling machines deliver the production you want to the precision standards you set. But Leland-Gifford also has in mind the importance of design for maximum utilization to make your purchase of a Leland-Gifford machine a gilt-edge, quick return investment.

For Automatic Drilling at its best . . . be sure to see Leland-Gifford

CALL THE OFFICE NEAR YOU

THE JOB: Drill and ream a complete line of screw machine master collets and feed fingers ranging from $\frac{1}{8}$" to $1\frac{1}{4}$" diameter.

THE MACHINE: A dual operating Leland-Gifford special with two work-holding fixtures and four standard self-contained drilling units equipped for either plain or step feed. Workpieces are drilled in one location, indexed to second location and reamed. Spindle speeds are precisely controlled through variable frequency input to ac spindle motors. Hydraulic feed is infinitely adjustable with separate motors driving hydraulic pumps at constant speed regardless of spindle speed.

LELAND-GIFFORD SPECIAL DRILLING MACHINES

WORCESTER 1, MASSACHUSETTS
U. S. A.

Chicago 5
2515 W. Peterson Ave.

Detroit
10429 W. McNichols Rd.

Cleveland 22
P. O. Box 853

New York Office
75 S. Orange Ave.
South Orange, N.J.

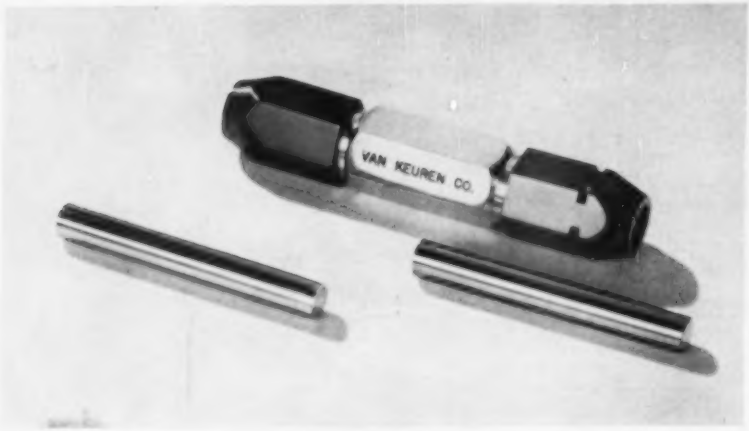
Los Angeles Office
2620 Leonis Blvd.
Vernon 58, Cal.

Indianapolis 6, P. O. Box 1051

Rochester 12, P. O. Box 24, Charlotte Station

IMMEDIATE DELIVERY

Van Keuren WIRE TYPE PLUG GAGES



WIRE TYPE (REVERSIBLE) PLUG GAGES were originated by **THE VAN KEUREN CO.** in 1923, and since that time have been supplied to an ever expanding group of manufacturing concerns throughout the country and abroad. The wire type design has enjoyed tremendous popularity because of the inherent economy represented by the fact that the gage units can be reversed, or cut off, to obtain substantial increase in gage life.

As a result of our long experience in developing and pioneering the manufacture of wire type plug gages and the sale of millions of these units, we have come to know what sizes will be required during a given period of time, and have prepared ourselves by finishing in advance a multitude of units which are in constant readiness for shipment. Our methods of size prediction through research and sales analysis have been successful to the point that there is now better than a four out of five chance that at any time we will have on hand the gage or gages that you need. In addition improved and highly efficient methods of manufacture developed during the years of our work in this field make possible the manufacture, to your requirement, of any size not on hand, in an incredibly short time.

VAN KEUREN WIRE TYPE PLUG GAGES are made to the most exacting requirements as to diameter, roundness, hardness, stability and surface finish. They are offered in all tolerances from XXX (.00001") to ZZ, and are available as units, in handles, or in sets.

VK

THE *Van Keuren* CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

deep, precision holes through thick pieces of metal is a specialty of this shop, but patent procedures prevent disclosure of the process at this time. However, the enclosed sample hole was drilled to the specification given above. Stainless steel, Type 347, was used.

As a favor to the party who wrote the "Challenge," it is requested that you forward to him a copy of this letter and the sample for his inspection and comment.

Milton A Frank
Frederick, Md

We are always glad to act as a clearing house between people with problems and people with answers—Ed.

Metal-ceramic bonds

Dear Sirs:

I have read with interest your "Metalworking Report" item emtitled "Why Metals Bond to Ceramic" (*AM*—Apr 6 '59, p3).

I am interested in learning the source of the information contained in the item so that I may acquire further details on metal-ceramic bonding.

I would appreciate it if you could furnish me with this information.

Lewis Balamuth
Long Island City, NY

The material presented in this item was abstracted from a report published by the National Bureau of Standards—the title: "Summary Technical Report, STR-2322."

Additional details can be secured from: Office of Technical Information, National Bureau of Standards, US Department of Commerce, Washington 25, DC—Ed.

"Great Scott, Baxter—you're too valuable a man to risk on the highways!"

CALENDAR

Material Handling Institute—National Exposition, June 9-12, Public Auditorium, Cleveland, Ohio.

National Association of Metal Finishers—Annual Meeting and Convention, June 14-16, Statler-Hilton Hotel, Detroit, Mich.

American Society of Mechanical Engineers—Semi-Annual Meeting, June 14-18, Chase-Park Plaza Hotel, St. Louis, Mo.

Society of Automotive Engineers—Summer Meeting, June 14-19, Chalfonte-Haddon Hall, Atlantic City, NJ.

Drop Forging Association — Annual Meeting of Members, June 21-24, Essex and Sussex Hotels, Spring Lake, NJ.

American Society for Testing Materials—Annual Meeting, June 21-26, Chalfonte-Haddon Hall, Atlantic City, NJ.

Pressed Metal Institute—National Meeting, Sept 13-17, Stanley Hotel, Estes Park, Colo.

Society of Automotive Engineers—Farm, Construction, and Industrial Machinery Meeting and Display, Sept 14-17, Milwaukee Auditorium, Milwaukee, Wis.

American Die Casting Institute—Annual Meeting, Sept 15-17, Edgewater Beach Hotel, Chicago, Ill.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Sept 21-25, Int'l Amphitheatre, Chicago, Ill.

American Welding Society—National Fall Meeting, Sept 28-Oct 1, Sheraton-Cadillac Hotel, Detroit, Mich.

Society of Automotive Engineers—National Aeronautic Meeting and Display, Oct 5-10, Ambassador Hotel, Los Angeles, Calif.

American Society of Tool Engineers — Semi-annual Meeting, Oct 8-10, Chase-Park Plaza Hotel, St Louis, Mo.

American Society for Testing Materials—Pacific Area National Meeting, Oct 11-16, Sheraton Palace Hotel, San Francisco.

Now...B & S Offers 20% Savings on 80% of End Mill Applications!

Thriftmill *Brings "Throw Away" Tool Concept to End Mill Operations!*

Why is the initial price of the NEW B & S Thriftmill 15 to 20% less than conventional end mills at a time when most other metal-working costs are rising?

This is a new exclusive design, a product of B & S progressive engineering and manufacturing techniques. The Thriftmill can be produced faster, more efficiently and therefore costs less.

Demand for the new Thriftmill is so phenomenal—large volume production lowers manufacturing and distribution costs.

Shop tested on profiling, slotting, peripheral milling and many other general end milling operations, the Thriftmill excels in over 80% of production applications. The new Thriftmill may mean new end milling economy and efficiency for you.

Ask your Distributor about the New B & S Thriftmill today! Send for new CONDENSALOG—easy to use specifications and prices on over 3300 "standard" cutters and end mills to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

FOR THAT EXTRA EDGE IN PRODUCTION

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

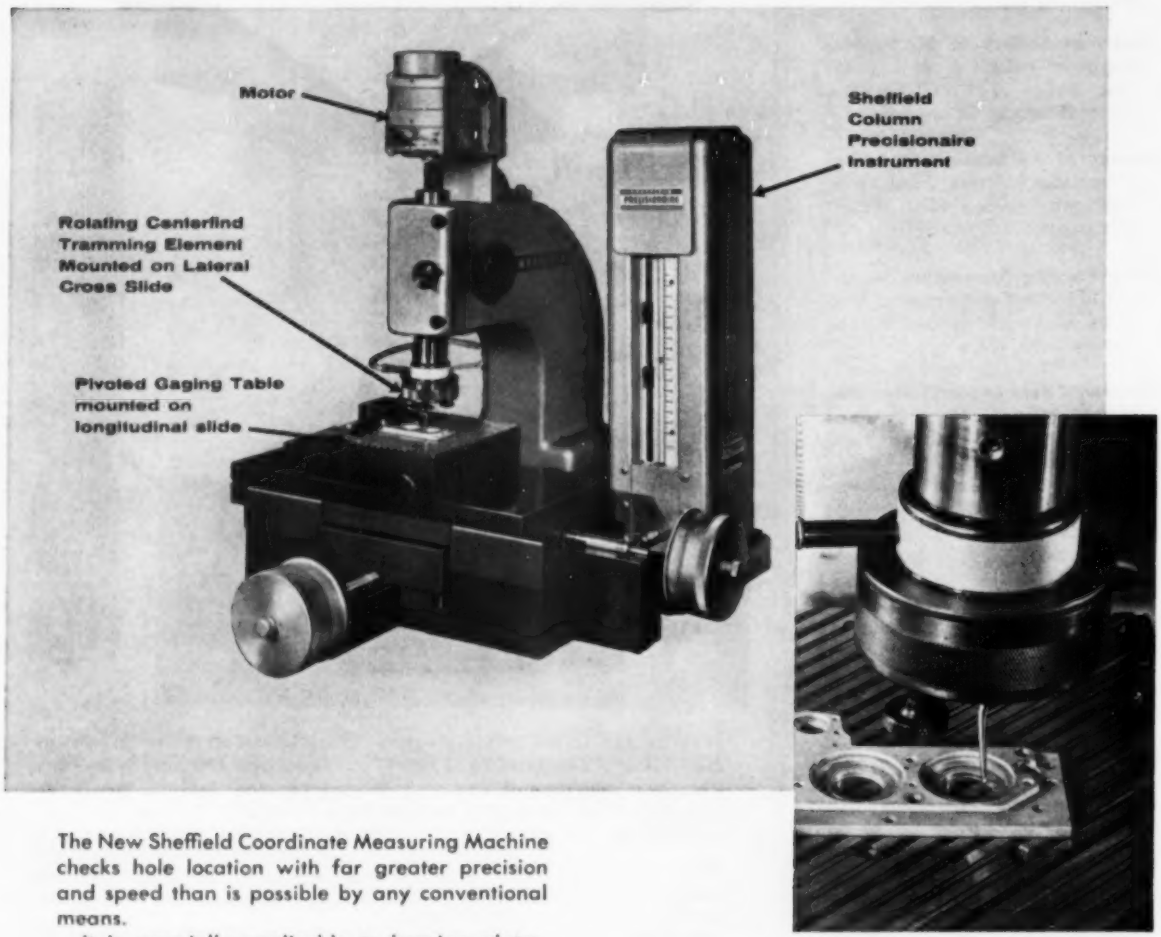
PROGRESS IN PRECISION FOR OVER 125 YEARS

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

NEW HIGH-PRECISION,

LOW-COST METHOD

OF CHECKING HOLE LOCATIONS


Motor
Sheffield Column Precisionaire Instrument
Rotating Centerfind Tramming Element Mounted on Lateral Cross Slide
Pivoted Gaging Table mounted on longitudinal slide

The New Sheffield Coordinate Measuring Machine checks hole location with far greater precision and speed than is possible by any conventional means.

It is especially applicable to bearing plates, computor and instrument frames, etc., having hole location tolerances of .0002" to .002" and hole diameters from .040" to 4.000". Measurement is not affected by hole diameter or tolerance.

A rotating adjustable Centerfind mounted on a cross slide is used to tram the hole and establish the precise position of the hole.

The work is clamped in place on a pivoted table mounted on a longitudinal slide. It is a simple matter to "zero in" two hole locations and advance from one bore to another according to print coordinates, setting up the dimensions with 4-inch barrel super-micrometers which read to .000010" and end standards. No complicated master setting gages are required.

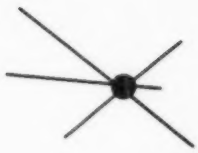
Easy to set up, to operate and to change over from one job to the next. Speed of setup and checking assures it will pay for itself in an amazingly short time.

Available with either electronic or pneumatic measuring instruments in three standard sizes — 6"x6", 10"x10" and 11"x18" — also special capacity models built to customer's order.

Write for COORDINATE EDS #193-58.
The Sheffield Corporation,
Dayton 1, Ohio, U. S. A., Dept. 1.

8039

the SHEFFIELD corporation
of Bendix Aviation
manufacture and measurement for mankind



BUHR

MACHINE TOOL COMPANY specializes in the design and construction of practical versatile multi-operation machine tools.

Basic features stressed in all Buhr machine tools include:

QUALITY—rugged design and manufacturing accuracy are combined to provide long trouble-free operation.

CONVERTIBILITY—**Buhr uses standardized "building-block" parts wherever possible in its machines, fixtures, etc. All such parts are held to interchangeability tolerances.**

PRODUCTIVITY—dependability is designed and built into Buhr machines to insure maximum productivity per man-hour consistent with production requirements.

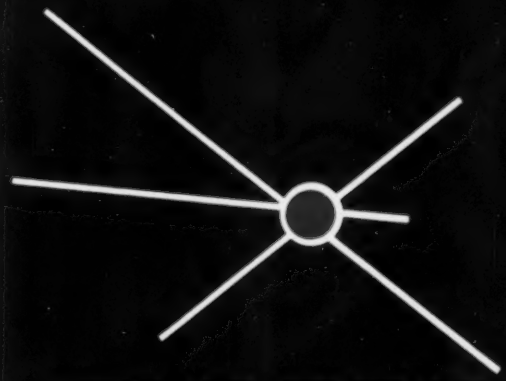
LOW DOWN TIME—every effort is made to minimize downtime by careful attention to future maintenance requirements, etc.

VERSATILITY—Buhr machines have a well-earned reputation in industry for their versatility. Many can produce a variety of parts with a minimum changeover time.

Buhr welcomes the opportunity of discussing your machining requirements. Give us a call or drop us a line.

BUHR
MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN



BUHR

the symbol of quality in multiple operation high and low production equipment

two examples

Buhr CONVERTIBILITY now adds years of useful life to machine tools

Convertibility, year by year, has become an increasingly vital feature of all Buhr Economatics. Today there is an even broader use than ever before of standardized 'building block' principles in Buhr machine components and fixtures while close tolerances on such parts insure maximum ease of convertibility.

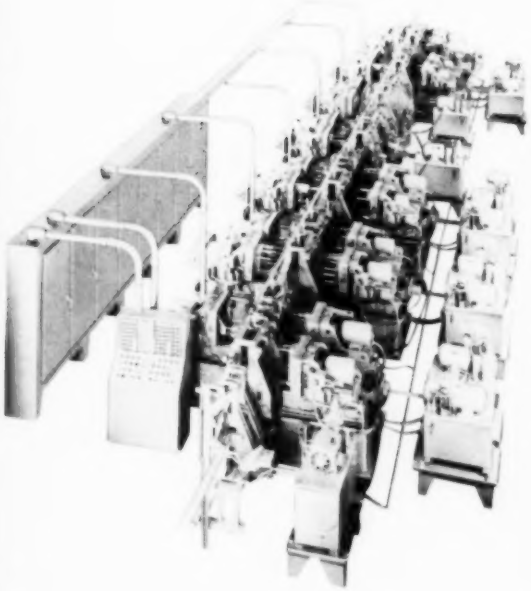
Today you can count on an even greater part of the original investment in an Economatic to stretch out amortization periods.

This part was redesigne basic machine still prod

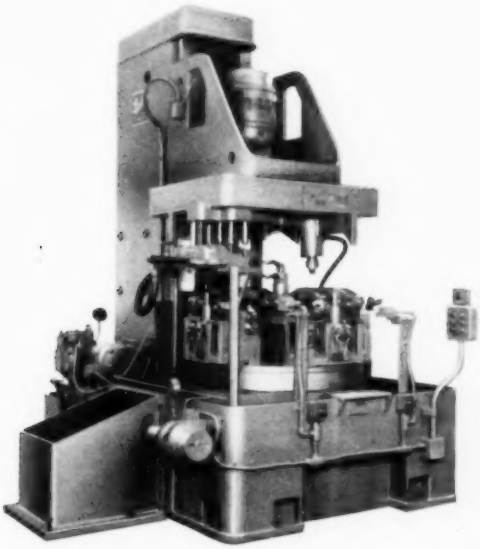
ORIGINAL: This 10-hp 6-station dial-index machine was the latest thing several years ago. It made power steering gear housings on a 33-second cycle.

Two recent exa can protect

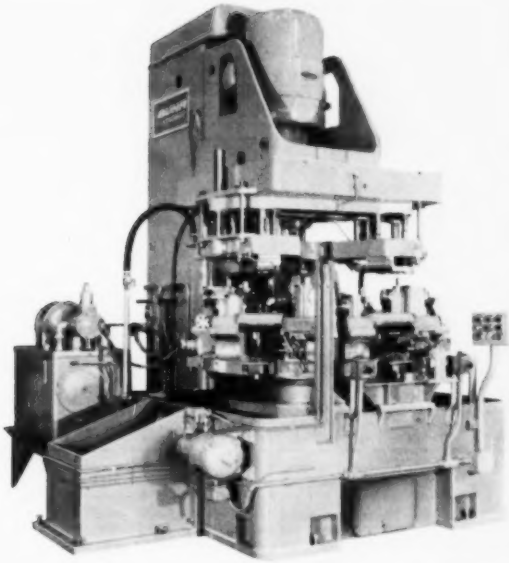
ORIGINAL: Three years ago, the then bra machine was producing torque converter h on a 23-second cycle. Plate blanks were one end of the machine and, after automat adapters came out the other end.



signed twice. The same produces it.



FIRST CONVERSION: Two years later, the machine was converted to a 4-station 15-hp dial, making somewhat different power steering gear housings on a 30-second cycle.

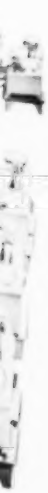


SECOND CONVERSION: Now, it is again a 6-station machine but with 40-hp main motor. Cycle time is still 30 seconds. The stepping up of power from 10 to 15 and then to 40 hp to keep pace with material changes illustrates the extra capacity built into Buhr machines. Conversion has simply kept it modern. Most of the original investment is still at work.

xamples show how *BUHR* convertibility ect your future machine investments

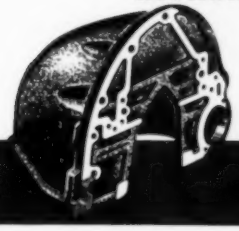
en brand new Buhr transfer erter housing adapter plates were automatically fed into utomatic operations, finished

FIRST CONVERSION: When the "2-dimensional" adapters were discontinued, the machine was not retired. It was converted to making *three*-dimensional torque converter housings. Far from declining in efficiency, output of the Economatic was stepped up. Cycle time was cut to 14 seconds although the number of operations was increased to 94.

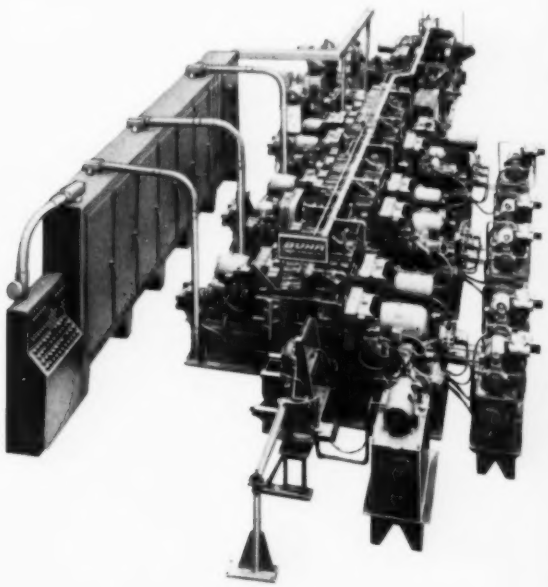


PRIOR TO 1958

on the same basic Economatic



NOW



STEERING KNUCKLES

These tough steel steering knuckles must be machined carefully to prevent distortion. Two at a time come off a 16-station transfer after 26 operations.

Transfer Machine #C-4572

7 different road machinery parts are produced on one automatic machine. Settings for different parts are pre-selected with a dial switch.

Shuttle-type Machine #C-4552

ROAD MACH'Y PARTS

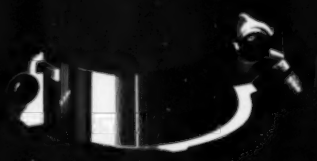
MANIFOLDS

Cast manifolds (both LH and RH) are produced at a rate of one every 21 seconds on a 20-station machine.

Transfer Machine #C-4524

Connecting-rod caps are made from steel forgings in 12 operations on an 8-station dial-index machine. Four caps are finished in an 18-second cycle and they can be used without preselection.

Dial Index Machine #C-4965



CONNECTING-ROD CAPS

Typical jobs on various *BUHR* Economatics

Any random selection is naturally incomplete. If you don't see a part that looks like yours, send us a part print and we will be happy to tell you what Buhr Economatics are doing to cut costs on your type of part.

BUHR MACHINE TOOL COMPANY

ANN ARBOR, MICHIGAN

Ask for more information by machine number

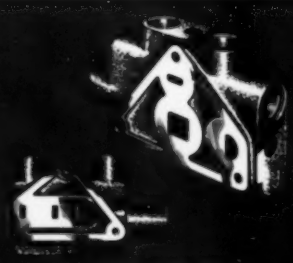
ALUMINUM OR CAST IRON

43 operations are performed on either aluminum or cast iron housings at 21 stations. Time cycle is 21 seconds per part.

Transfer Machine #C-4098

From 19 to 28 operations per part are performed on 32 different valve body styles on the same machine with only simple tool changes.

Trunnion Machine #C-5021



VALVE BODIES

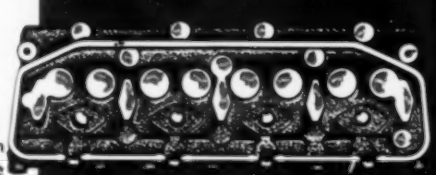
AXLE HOUSING

On this part, a short Buhr Economatic transfer machine has eliminated an annual retooling cost averaging $40,000 per year.

Short Transfer Machine #C-5188

All spark plug holes are combination drilled and reamed on a simple 2-fixture 4-station machine with a 12-spindle head.

Single-station Machine #C-4941



CYLINDER HEADS

SPOT NEWS...

- **Total military spending for new plant and equipment** will drop from $351 million this year to $272 million in fiscal 1960.
- **Congress wants to sell off $4 billion worth of surplus metals,** alloying materials and similar items in the $8-billion national stockpile. Odds are against any quick opening of the spigot, however. Involved are: abrasives, aluminum, cadmium, chromite, copper, graphite, lead, magnesium, mercury, molybdenum, nickel, rubber, tin, tungsten, vanadium and zinc.
- **Britain has come up with an American-styled plastic-bodied car** designed for the U S market. The "Shamrock" is powered by an Austin A-55 engine, is a two-door convertible. Body is made from laminated polyester resins and fiberglass. Chassis is of pressed steel. It'll sell for $1700 here.
- **Official: the Big Three automakers will build small cars:** Henry Ford II and Chrysler's L L Colbert chose May 21 to confirm that "barring unforeseen market conditions" their companies will have small cars, named Falcon and Valiant, respectively, for fall introduction. Next day, GM chairman, Frederic G Donner, announced that GM will build and market by this fall an "American light car" called the Corvair. (First report of small cars appeared in AMERICAN MACHINIST 15 months ago—*AM*—Feb 24 '58, p89.)
- **Central hydraulic systems for passenger cars** will become a reality within the next 15 to 24 months, a leading Big Three automotive engineer told AMERICAN MACHINIST. A similar system for commercial vehicles is under parallel development. From a central power source, it will operate brakes, steering, windshield wipers, starters, window lifts and adjustable seats.
- **Auto manufacturers are planning the shortest possible close-down periods** for new models this year, in this way hope to attain about two months more production in the model year than they did last year.
- **Pentagon's latest drive to break up idle packages** of military-owned machine tools is a key factor in reduction of government spending for new production equipment. Latest Defense Dept figures show that last year 210 packages of machine tools were broken up, releasing more than 17,000 items for use elsewhere in the military establishment or for assignment to the government's tool reserve.
- **Why do companies fail?** A National Screw Machine Products Association panel came up with these reasons: absentee management, labor troubles, lack of long-range planning, "too many eggs in one basket," unrealistic pricing, gambling with a government contract, errors in estimating, failure to delegate authority, placing responsibility with wrong people, poor customer relations.
- **It's an ill wind that blows no good.** Some appliance manufacturers (particularly those coming out with new lines this summer) think a prolonged steel strike may give them a chance to unload inventories of old models.
- **An electronically scheduled overhead conveyor and transfer system** a mile-and-a-half long is the core of Singer Mfg Co's new household sewing machine plant in Elizabethport, NJ. The system has eight conveyors, the most sophisticated being the electrostatic-paint-line conveyor. This is 1660 ft long, has three drives and four power takeoffs. The foreman dials in his part mix and rate in the morning, then lets controls take over. The controls automatically shut the line down in case of malfunction and indicate the trouble spot.
- **Metalworkers are being rehired at a faster clip** than workers in virtually any other segment of the economy. Exception is the auto industry, still with the highest unemployment rate among manufacturing industries—8%. Among factory workers, "operative" employees (operators of fork trucks, machines, etc) have the highest unemployment rate (7%), while between 5 and 6% of craftsmen and foremen are still out of work.

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Get your share and keep it there!

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INDUSTRIAL DISTRIBUTOR

Threadwell's fine line of cutting tools and gages is one guarantee of uninterrupted production, the surest way to stay in a competitive position.

To get out front and stay there make sure you include your Threadwell Distributor in your production planning.

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.

WASHINGTON...

Renegotiation to be extended . . .

The controversial Renegotiation Law will be renewed with little of the liberalization sought by defense contractors. The House Ways and Means Committee has okayed a bill extending the law four years (the administration seeks only a two-year extension), retaining most of the tough rules opposed by arms makers.

The Act's extension does give defense contractors two major concessions: (1) It requires the Renegotiation Board to spell out details on how it makes excessive profit determinations in individual cases, thus making it easier for contractors to prepare appeals on board rulings; (2) It allows for appeals from Tax Court decisions on Board rulings in the U. S. Court of Appeals.

But the committee voted against the defense producers' plea for an exemption from renegotiation for contracts with incentive clauses and for a provision guaranteeing a set rate of profit on defense work.

Metal Trade Fight . . .

An AFL-CIO high command feud over the right of metal trades unions to organize in competition with industrial unions is still simmering after a near settlement.

AFL-CIO President George Meany thought he had an acceptable peace plan worked out by Federation vice presidents—Joseph Keenan for the crafts and Joseph Bierne for the industrial unions. But when Bierne authored a report giving the metal trades unions the right to organize as a department for production and maintenance workers—provided they could show jurisdiction—his old CIO associates rose up in arms.

They are still demanding that the crafts must organize separately; that they can no longer do across-the-board organizing in competition with the steel, auto and other industrial unions.

The craft vs industrial union rivalry is particularly acute because higher skilled jobs in automated factories are increasing, while production jobs are falling.

Taft-Hartley reform . . .

Reform legislation is still touch and go. But if Congress approves a bill it's likely to be tougher than the labor unions want. Labor lobbyists are hard at work to tone down the Senate's Kennedy-Ervin bill to their liking. But the House Labor Committee is going the other way, by proposing curbs that the Senate-passed Kennedy-Ervin doesn't offer.

AFL-CIO strategists will attempt to kill any tough bill, but first they will try for a reform measure that doesn't include a "Bill of Rights" or curbs on organization picketing and secondary boycotts.

However, the current mood of Congress, despite its liberal tone, is a crack-down on labor racketeering.

Air defense missiles . . .

Future production schedules for surface-to-air missiles have been put under a cloud by a new Pentagon reappraisal of air defense policy. Objective is to re-examine duplicating weapon systems and to weed out marginal ones. Behind the new study is the argument of some military strategists that the U.S. is spending too much on air defense missiles which provide only marginal protection, that the funds should be spent on offensive weapon system. In essence, this is the old argument that the best defense is a good offense.

On its own, the Defense Dept has scaled down total new orders for the Nike Hercules, Hawk, and Bomarc air defense missiles some $390 million from this year to about $710 million worth of procurement in fiscal 1960. But new orders for the Navy's Talos, Terrior, and Tartar ship-to-air missiles will be boosted.

Now the Senate Armed Services Committee has ordered a freeze on construction of new Nike Hercules bases, has tied up $50 million in building money voted last year (but still not contracted out by the Army) for more than 25 new bases.

The action doesn't directly affect the missile production budget. But it's now likely the Army will hold back output of Hercules missiles and supporting electronic gear—except for replacement parts—unless the construction freeze is lifted.

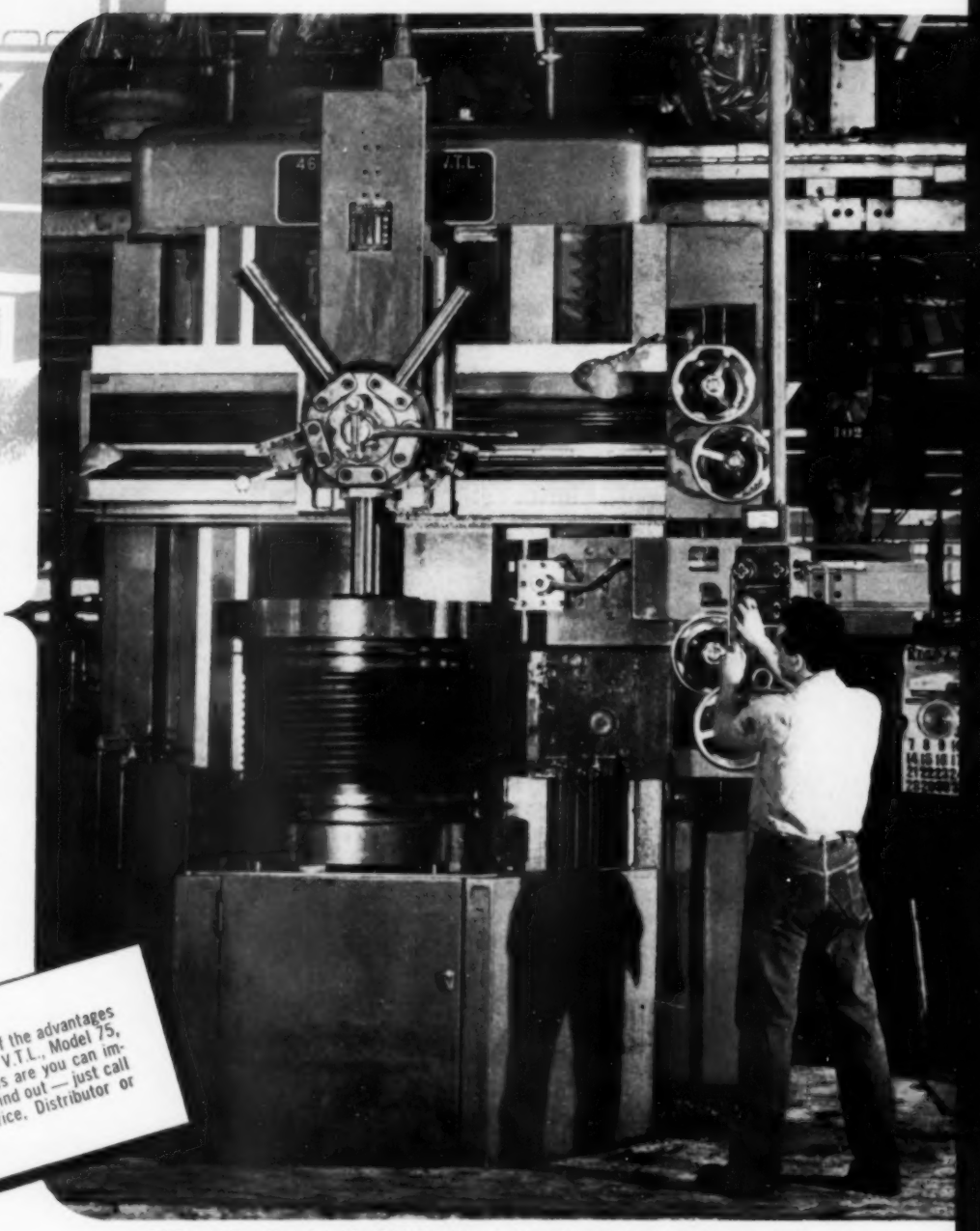
Missile spares vs aircraft spares . . .

The production trend from aircraft to missiles has allowed the Pentagon to slice its unspent carryover funds (a perennial sore spot to Congress) from $8 billion to under $6 billion over the past two years. Up to now, much of the carryover was earmarked for manufacture of spare parts. For new aircraft, 20% of total production costs now cover output of initial spares (down from 30% last year). On missiles, the military puts only 5% of the production cost aside for fabrication of spares.

It Pays To Replace

An analysis of cost records at Philadelphia Gear Corporation, Philadelphia, Pa., shows, according to Mr. John Walker, Shop Foreman,

"A savings of up to 30% in overall production over our older 42" Bullard V.T.L. with our 46" Cut Master V.T.L., Model 75."



This saving is accredited to the following built-in features of Cut Master, Model 75:

Greater rigidity and solid construction – allows heavier cuts.

Greater accuracy with accurate finishes – reduces spoilage.

Simultaneous cutting with turret and side head – reduces machining time.

Ease of operation with Pendant Control – reduces operator fatigue.

Low maintenance cost – less down time.

One shot lubrication system – assures adequate oil to all parts of the machine.

BULLARD

Unless you are now employing all of the advantages offered with a Bullard Cut Master V.T.L., Model 75, to your machining jobs — chances are you can improve your production. Why not find out — just call your nearest Bullard Sales Office, Distributor or write

4,000 pound Drum for gate hoist which is bored, faced and turned on 46" Bullard Cut Master V.T.L., Model 75.

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

CIRCLE 344 READER SERVICE CARD

DETROIT...

Success in Dearborn...

The millionth 1959 model Ford passenger car came off the Kansas City assembly plant lines on May 15. The milestone unit was nearly one full month ahead of original planning estimates, and sales continue to boom.

Ford's pace is nearly 50% ahead of 1958 as a result of nine consecutive schedule hikes that have added 140,000 cars to the total. The division is also running first in registrations, showing a year-to-date margin of 2000 over Chevrolet.

Demand for the six-cylinder engine is so great that it is being built on a round-the-clock basis. Waiting periods of up to a month for this option have undoubtedly sent many would-be buyers to the competition. As a partial solution to the problem, Ford is now offering to rebate to dealers the full extra cost of a V-8 engine, with the idea that the savings can be used as bait for economy-minded customers.

Even greater future optimism was shown by Ford VP C R Beachman. He recently predicted: (1) Industry sales in the second quarter will be 35% above second quarter last year and higher than the corresponding period for 1957, (2) Sales in the third quarter will be 40% higher than 1958 and will approximate 1957, (3) Fourth-quarter sales will be significantly better than either 1957 or 1958 — especially if 1960 models live up to expectations.

The Third Column . . .

A smoldering, underground war with few tactics barred has developed in recent years between suppliers of competing automotive materials. The odd result is that the men who actually design the cars have found themselves out in the middle of no-man's land dodging brickbats.

The feuds have bred some strange alliances. For example, the various primary aluminum suppliers, who normally won't speak to each other, are one in their attack on all forms of steel used in automotive trim. Several have treated automen to elaborate shows, featuring all-aluminum cars of the future, in attempts to upset the habitual assumption of steel usage in structural body parts.

Steel makers, of course, are fighting back with equal vigor despite clashes of interest within their own camp. Here, nickel, as used in chrome plating is being touted on Detroit radio stations as superior by inference to stainless steel, which also contains goodly amounts of nickel.

Chemical companies that produce the plastic sheet used in laminated safety glass are telling auto engineers via consumer advertising that this type of glass is safer than the tempered variety, which it is not.

An association of "genuine" leather producers is spending millions in a rear-guard action against the inroads of cheaper vinyls that are getting to look and feel more like leather than leather itself. Makers of polishes are just cranking up to deny auto industry claims that the new melamine enamels and acrylic lacquers never need waxing. Oddly enough, the principal supplier of acrylic lacquer (DuPont) is also one of the nation's largest producers of polishing compounds.

There is discord within single suppliers who produce both rayon and nylon cord for tires. Nylon is out for the lush original equipment tire market, and rayon will defend itself down to the death of its last salesman.

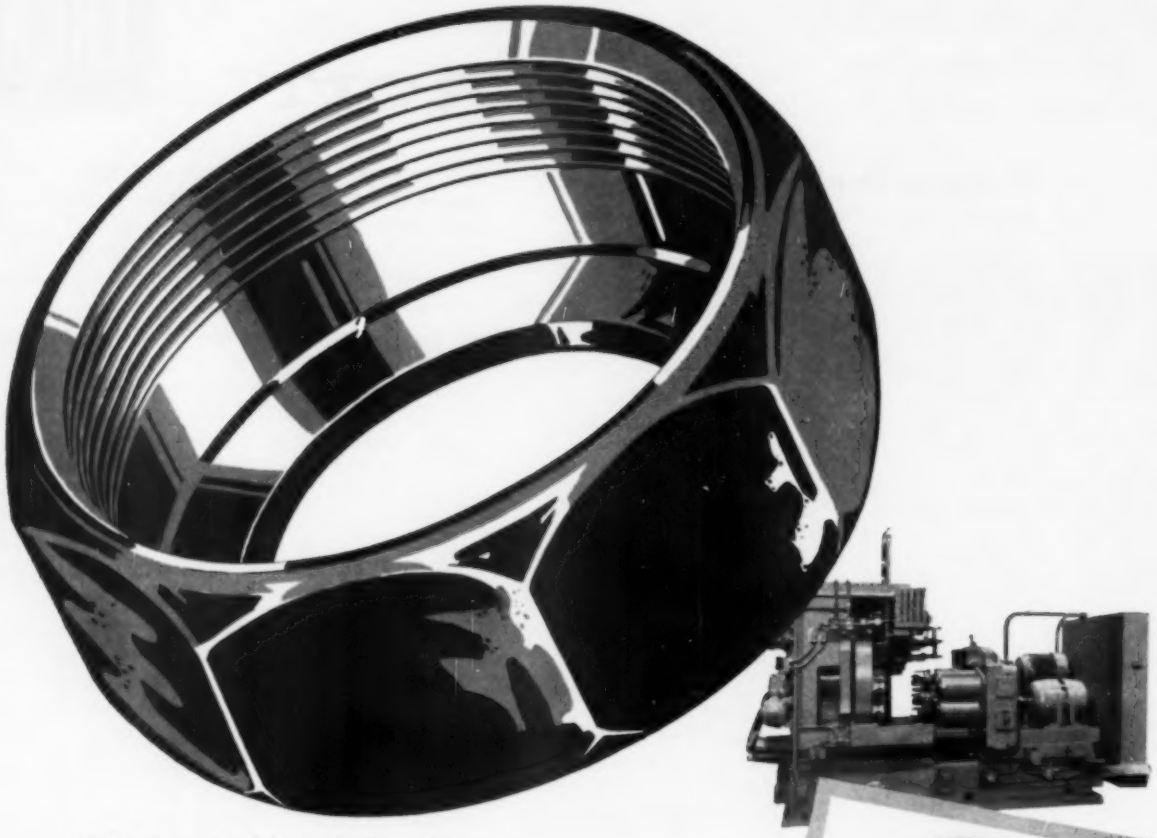
Lastly and most recently, plastic producers are touting new resins such as Teflon, Delrin and Zytel as suitable substitutes for metal gears and bushings in certain applications. Rigid linear polyethylenes of various brand-names, as well as DuPont's new acetal resin, Delrin, aim at replacing steel and aluminum structural parts.

All of this is commendable in one sense — because it means progress. But auto engineers are becoming outspokenly annoyed at some of the tactics used. This is particularly true when the material makers try to influence the public to in turn influence the engineer by demanding this or that material in new model cars.

Examples that sting most involve accusations that present materials are unsafe, as in the glass and tire cord promotions. The latter even bypasses the man who should know the most about tire safety; namely, the tire maker. Almost equally rage inspiring is the polish makers' claim (implied) that auto makers are liars.

One leading auto man, annoyedly sampling a supplier's martinis after an uncommonly lengthy filmed treatise on design deficiencies in today's cars, told us that a new material can get into his shop for only three reasons: (1) When it does the same job for less cost, (2) when it does such a superior job that cost within reason is not a factor, or (3) when there are temporary periods of artificial shortages. "I don't mind being prompted to think," he snapped, "but I dislike being pressured, especially in public."

...an example of Automatic Production by Greenlee...



700 malleable iron pipe fittings an hour...

The Greenlee 5 station, horizontal, automatic indexing machine shown above was designed and built for high-production machining of malleable iron pipe fittings. The pipe fittings are loaded, four at a time, indexed and machined at the rate of 576 to 712 pieces an hour, depending on size. The machine accommodates five different sizes of fittings.

STATION 1 — automatic load
STATION 2 — bore and rough counter-bore
STATION 3 — finish counter-bore and chamfer
STATION 4 — tap
STATION 5 — automatic unload

Let a Greenlee representative show you the modern Greenlee approach to automatic production.

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- Multiple-Spindle Drilling and Tapping Machines
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AIRCRAFT and MISSILES...

TRENDS

New York-California hassle...

"We must not tolerate making a WPA out of our nation's defense effort." That's the sum and substance of California's statewide effort to squelch New York-proposed geographic restrictions on defense contract awards.

New York wants to know why it has only 12% of U S missile contracts while California has more than 21%. L A Chamber of Commerce President J E Fishburn says it's because California's "natural climatic and living conditions have attracted more than 25% of the nation's scientific brainpower."

California Chamber of Commerce managers are banding together "to use every resource at our disposal to fight this unwarranted attack by Eastern legislators seeking Congressional intervention in a competitive defense market."

In Washington, California's Senator Kuchel forecast that the "New York Bill," simultaneously intoduced by 40 Congressmen from that state, will "end up in the ash can where it belongs."

"Competitive bidding" ruckus...

New York Senators Javits and Keating are cosponsors of the bill, which is designed to force more competitive bidding (at least two firms involved in all negotiated contracts) and "prime consideration" for labor surplus areas, and for small businesses and suppliers. Their claim: more than 85% of defense contracts are now negotiated and California gets most of them.

California's Senator Engle in a Senate debate pointed out some fallacies in attempting to solicit competitive bids on such complex products "that haven't even been designed yet."

California's aircraft and missile manufacturers are particularly bitter over the New York-coined phrase, "competitive bidding," which they claim is nothing more than a system that would force the government to give major consideration to factors other than performance capability. Such legislation, they claim, would be dangerous not only to the defense program but to all defense contractors, regardless of size or location.

ICBM speedup under study...

Expanded production of Atlas ICBMs and a stepup in the Minuteman ICBM development program are being considered by the Defense Dept.

The "maximum" proposal on Atlas—which ARDC's General Schriever is pushing—would involve the increase of seven operational squadrons, from nine now planned to 16. It would mean expanding output from 90 missiles for operational emplacement to 160, three-shift production for Convair, and a total extra cost of some $2.5 billion over the next three years.

The Defense Dept already has some $500 million uncommitted on this year's books with which to step up the two ICBM projects—extra funds voted by Congress last year for additional production which the Pentagon has yet to contract out. At the same time, Congress is also expected to tack on extra funds to the fiscal 1960 budget for ICBM projects.

The Atlas speedup recommendation was made by Air Force Secretary Douglas after considerable debate within the service. General LeMay, Vice Chief of Staff, has made no secret of his dissatisfaction with Atlas, would prefer to use extra Air Force money for bomber procurement. It's not known whether Douglas has accepted the "maximum" speedup plan or has scaled it down.

Status on Minuteman...

The Minuteman speed-up proposal comes on the heels of Defense Secretary McElroy's recent report to Congress that the project is already being pushed as fast as possible. Project officials, however, pooh-pooh the claim and argue that Minuteman's budget must be hiked if target dates are to be met.

The Air Force's schedule calls for "initial opertional capability" for Minuteman—that is the first few missiles in the hands of troops—in 1963.

The missile is not expected to be operational in quantity until 1965. First flight of a complete prototype is not likely before 1961.

The project's budget for this year totals some $200 million—including an increase of some $114 million under pressure from Congress. Next year's budget amounts to $260 million.

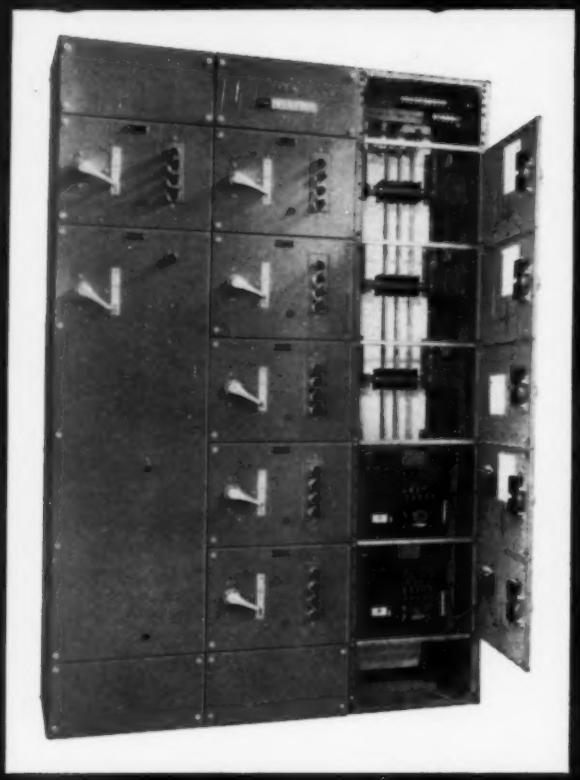
More review on budgets...

Senator Russell (D-Ga,), chairman of the Senate Armed Services Committee, wants to get into the aircraft-missile budget review. He's pushing a bill to require specific "authorization" legislation by his committee before the Senate Appropriations Committee could vote out a military appropriation for aircraft and missile procurement.

By tradition, the Committee already acts on "authorization" bills for military construction and naval shipbuilding prior to Congressional appropriation of funds.

In Control Centers...

Federal Pacific gives what you're looking for



RELIABILITY

BOLTED CONSTRUCTION—11-gauge formed channels bolted together for maximum structure rigidity.

POSITIVE PLUG-IN CONTACTS—special beryllium copper alloy stabs provide high-pressure, low-resistance unit-connections to silver-plated bus.

TESTED TO WITHSTAND 25,000 AMP RMS SHORT CIRCUIT STRESSES.

FLEXIBILITY

PREPUNCHED STRUCTURES—for unmatched job flexibility...individual units or complete sections can be added, removed or interchanged to meet varying job requirements—present and future.

COMPACT DESIGN—up to 20 units can be mounted in a single vertical section.

EASY WIRING—oversize wiring spaces simplify initial installation and facilitate change of units.

SAFETY

UP-FRONT UNIT RELEASE—completely disengages unit from energized bus... can be locked in open position to prevent accidental contact.

FULLY ENCLOSED UNITS—steel barriers isolate each unit from adjacent parts.

DOORS MOUNT ON STRUCTURE—prevent accidental contact with energized bus when starter unit is removed.

Nothing has been left to chance in the design of this control center. Structure, starters, and protective devices have all been carefully engineered, manufactured and coordinated by Federal Pacific to assure the highest standard of operating efficiency and dependability—as well as to provide unified responsibility for performance. For complete details write for Bulletin 2-2000A, Federal Pacific Electric Company, General Offices: Dept. 305, Newark 1, New Jersey.

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The Best in Electrical Distribution and Control Equipment

MACHINE TOOLS...

Business in upswing...

Net new orders for machine tools are moving in the right direction. In April, the total in cutting types was $39.1 million, almost the same as in March. For the first four months of 1959, orders added up to $144.1 million, a healthy gain of 53% over the unhealthy volume in the same period in '58.

For two consecutive months net orders for cutting type machine tools have been running close to an annual basis of half-a-billion dollars. While this level of sales is far below the better years in the industry, it is a considerable leap up from where the volume has been.

Orders for forming type machine tools have stayed very close to the $10 to $11 million mark every month this year. The April figure was $10.8 million.

The January-April total of $42.8 million is a husky 68% above the similar months of last year.

Shipments looking up too...

Shipments of both cutting type and forming type machines suffer by comparison with 1958 for the simple reason that builders came into this year with backlogs severely depleted. Nevertheless, shipments of cutting type machines amounted to $32.9 million during April, whereas in January they were only $23.4 million. April's production of forming type machines is reported to be $10.8 million, as against $7.9 million in January.

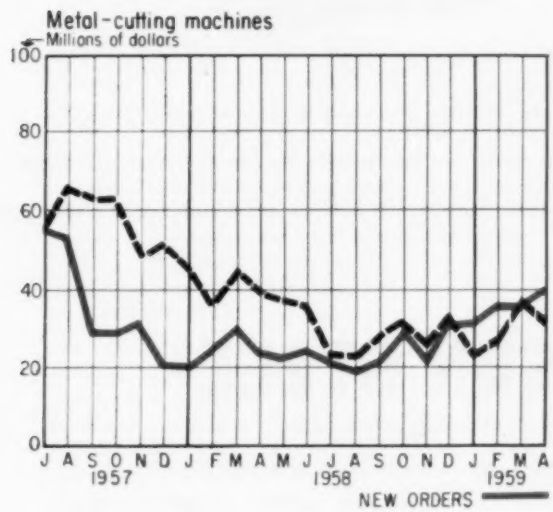
The feeling all along has been that machine tool orders will be better the farther the year progresses. The volume thus far in 1959 has been higher than many builders anticipated. Even so, it is still far from satisfactory.

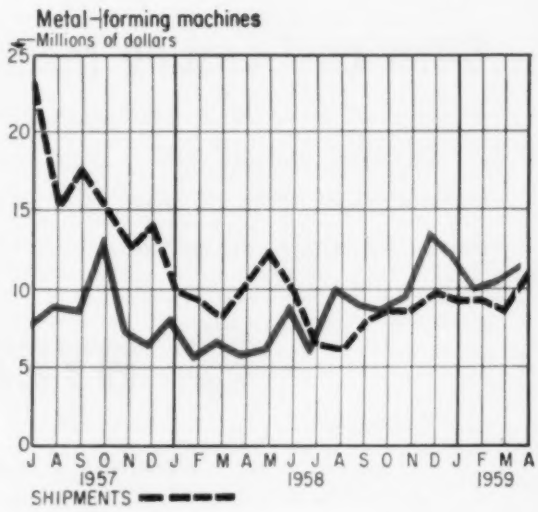
The new orders forecast for metalworking machinery, made periodically by the McGraw-Hill Department of Economics, points to 161 for the second quarter (1950=100), 157 for the third quarter and 167 for the final quarter of this year. Actual index figure for the first quarter was 144. Prediction is that orders in the first quarter of 1960 will reach 176.

Foreign tools and dies shunned...

Makers of automobiles, household appliances, business machines and aircraft are not buying tools and dies abroad except for trial purposes. Moreover, they have no intention of doing so. They expect to continue placing the major portion of their tooling work with independent contract tool and die shops.

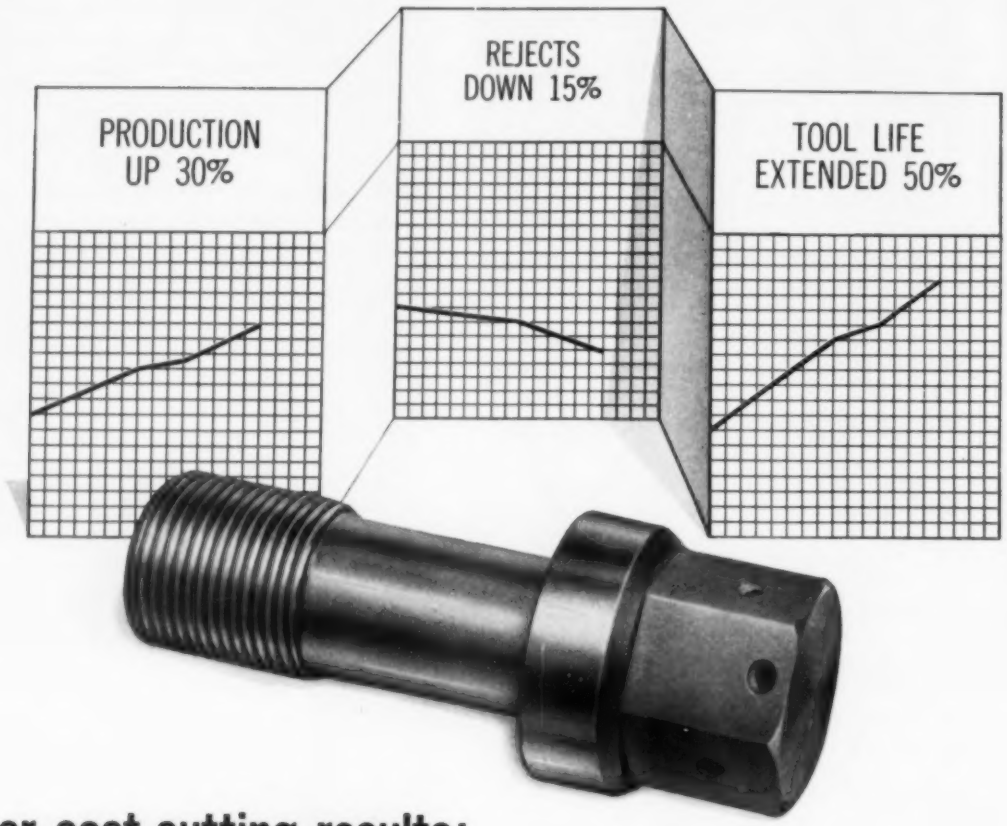
These conclusions came out of a survey conducted by the National Tool & Die Manufacturers Association among 10 leading U S companies. Two firms admitted that they had imported single sets of trial tools but did not plan to buy more abroad. Other companies have not purchased any foreign tooling. A major West Coast aircraft maker will start a program this fall calling for a minimum of 1.2 million manhours of outside tool and die work that may run into 1961.





Value analysis boosts production 30%

This was the outstanding result when a metalworking company studied and evaluated production of piston pin bolt heads with a Ryerson representative. The Ryerson specialist recommended Rycut® 40—the world's fastest machining alloy steel in its carbon range.



Other cost-cutting results:

In addition to boosting production, this risk-proof Ryerson alloy reduced rejects 15% . . . increased tool life 50% . . . and gave parts a better finish. Ryerson value analysis of materials and methods may help solve some tough problems for you. Contact your nearby Ryerson plant for details.

RYERSON STEEL®

Member of the INLAND Steel Family

STEEL • ALUMINUM • PLASTICS • METALWORKING MACHINERY

NATION'S MOST COMPLETE SERVICE CENTERS IN PRINCIPAL CITIES COAST TO COAST

MATERIALS...

Hot-work properties tested . . .

To control microstructural variations to a degree which cannot be obtained by any other procedure, heat-resistant alloys are being studied at the University of Michigan. A better knowledge of the relationship between microstructure and creep-rupture properties may lead to structures with superior properties.

"A"-nickel was used to study the effect of working on properties in the as-worked condition. A-286 alloy was used as an example of a material whose properties are influenced, after solution and aging treatments, by the conditions of prior working. The studies, conducted by A P Coldren and J W Freeman under the USAF's Wright Air Development Center auspices, will define the basic principles for use in developing optimum properties in any alloy.

Stress-relaxation test unreliable . . .

Analysis of stress-relaxation tests has resulted in a strong recommendation to completely discontinue uni-axial relaxation testing. Instead, new flexing procedures should be developed to determine the stress-rate effect under uni-axial as well as under two-dimensional and three-dimensional states of stress—both with and without superimposed temperature fields.

According to A M Freudenthal of Wright Air Development Center, relaxation data can be obtained only from actual relaxation tests. Conversion of creep data into relaxation data, either directly or by way of "isochronous" stress-strain relations, produces highly unreliable results.

Practical transmutation?

Radioactive processes, says Ivan Bardin, vice president of the Soviet Academy of Science, will help engineers "design" metals of the composition they need without the necessity of introducing expensive and rare admixtures as they must today. He forecasts that synthesis of elements, by changing the structure of their atomic nuclei, may enable the production of ores of rare and widely scattered elements in the quantities needed by industry.

One cannot help wondering what, if any, connection exists between Dr Bardin's forecast and last year's announcements, by Soviet Minister of Mines Anropow, of the vast ore deposits in Siberia and the far-eastern provinces. As we mentioned in announcing these fields, a great quantity of effort and capital equipment stands between ore and an ingot of pure metal. Perhaps, in the USSR, it is more practical, or quicker, to develop transmutation processes than it is to refine the metals.

New magnesium–rare earth metal . . .

For missile applications, a new magnesium—rare earth metal alloy, designated EK31XA, has been deveolped by The Dow Chemical Co. (Midland, Mich). A number of prospective users of the alloy are evaluating sand castings produced of the new alloy by Dow. Didymium is the rare-earth metal. The alloy contains 3.2% of it plus 0.6% zirconium; the balance is magnesium.

Sand castings of this alloy combine good room-temperature tensile properties with excellent tensile strength at 600 F. They also offer excellent creep resistance at this elevated temperature for up to 10 hr, according to Dow. In long-term properties, including creep strength up to 1000 hr, the castings are serviceable to about 450 F.

EK31XA alloy is readily castable, it can be welded by argon-arc or helium-arc methods, and it can be finished by standard magnesium finishing technique. Dow pointed out that it also is proving to be a good forging alloy.

Next outstanding material . . .

We asked a metallurgist recently what he would nominate as the next outstanding manufacturing material. He might have said superalloys, or inorganic polymers, or reinforced plastics, or tungsten, or silicon carbides, or one of many other materials under recent development. Instead, to our surprise, he said "wood." Then, quite earnestly, he pointed out that of all the manufacturing materials being researched by man, wood is receiving the least attention. Perhaps it is too commonplace. He may have a point. Our friend mentioned that, in its natural state, wood offered a variety of characteristics via its many forms: lightness, strength, wear resistance, flexibility, heat resistance, formability, etc. Then, he said, it can be treated, impregnated, or densified to open many more characteristics. Wood has been, and is being, used for gear teeth, shaft bearings, roller-skate wheels, pipe, forming rolls and dies, and many other mechanical components. Yet, its full potential is untapped. We'd appreciate receiving your opinions—about his opinion and the next outstanding material.

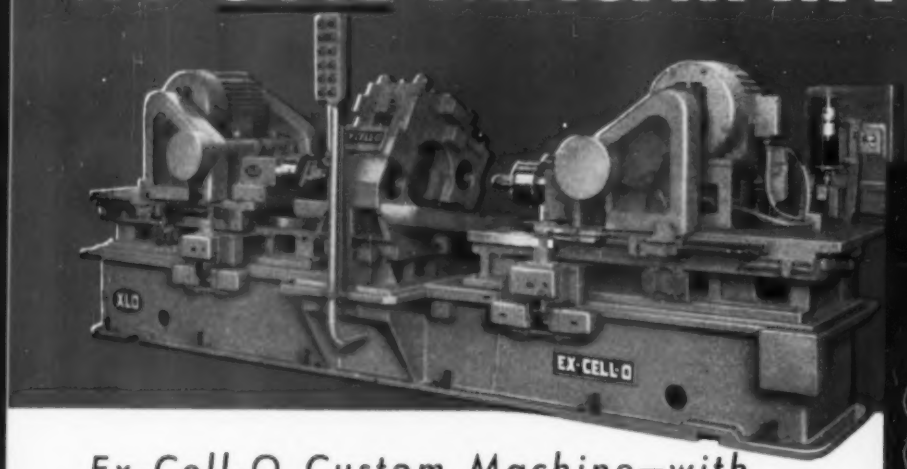
FROM ROUGH...

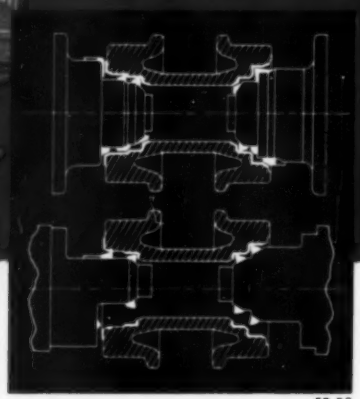
Heavy boring and plunge-facing

TO FINISH

Precision boring and facing

IN ONE MACHINING CYCLE





59-23

Ex-Cell-O Custom Machine—with quick-change tooling—speeds output of large, cast-iron track rollers

This Ex-Cell-O Custom Machine features precision—in a big way.

A track roller for rugged, off-the-road equipment, is clamped in the hydraulically-actuated fixture; the rest—from rough to finish—is automatic.

The part is first rough-bored on both ends at the same time. Then both slides retract and the fixture indexes into position for finish boring and facing at both ends, simultaneously. (Drawing, above-right, shows rough and finish tooling.) Slides again retract and the fixture is unclamped, ready for the next cycle. Easily changed tooling heads and clamping jaws permit precision machining of any of three similar components with minimum lag in production.

See your Ex-Cell-O Representative, or write direct for full details on Ex-Cell-O Custom Machines—specially designed with extended capacity for changing production needs.

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
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CIRCLE 248 READER SERVICE CARD

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking output is back at pre-recession levels...

Metalworking production is now definitely headed back toward the peacetime record level reached late in 1956, is already at the high pre-recession levels of 1957.

Most noteworthy comebacks have been made by the automotive and electrical machinery industries, with the slow-to-recover machinery category now definitely on the upswing.

Basic metal production, notably steel, is smashing all-time records for output and shipments—due of course principally to hedge-buying of steel against the threatened strike.

Most steel producers are by now resigned to a work stoppage. Predictions: 4 to 10 weeks.

But advance orders for the post-strike period are picking up at the steel mills. Result is July business will be very heavy and high operational levels should continue well into the fall.

Steel warehousers say demand for sheet and galvanized products is running 60% ahead of last year, with structurals running only 12% ahead.

Warehouse inventories are now estimated at more than 3.5-million tons (about a five months' supply), but sheet supply in some areas is down to three months or less. This situation could be complicated still further if Steelworkers' Union-controlled warehouses (about 10% of U S warehouse capacity) strike along with the union.

Current automobile sales levels are apparently high enough to dispel fears that field inventories are the highest in history (about 1-million units). The industry is now beginning to accept much higher inventories as normal.

Auto people are optimistic about the third quarter despite possible paralyzing results of a prolonged steel strike. For one thing, foresight has built up steel inventories to the point where production will continue uninterrupted through any reasonable (4-5 weeks) strike period.

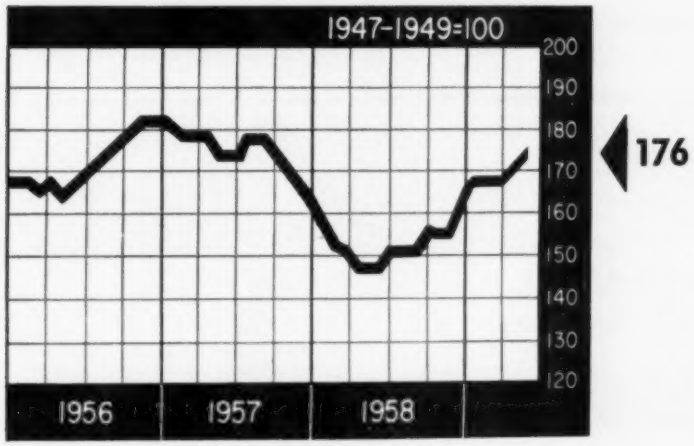
Other consumer durable goods are booming too —particularly appliances. Most appliance manufacturers report business is well over 50% ahead of last year, and is far ahead of the total for the corresponding month in record 1955.

One company reports that its home freezer sales in the first quarter rose 248% above comparable 1958. Other big first-quarter gainers: ranges 96%, clothes dryers 47%, automatic washers 61%.

Radio and television output is booming. One major manufacturer, for example, reports that portable radio sales are up 15%, clock radios 20%, table radios 10%.

Even more spectacular gains are recorded for: auto radios—40 to 45% over last year, television sets 40%, and hi-fi sets (including stereo) up a whopping 110% over last year.

Those metalworking products based upon housing starts are all doing better this year—water heater sales and output are up 10% over comparable 1958, and home heating and air-conditioning units are up 20-25%. Outlook in these industries is for a continued gradual pickup through 1959.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

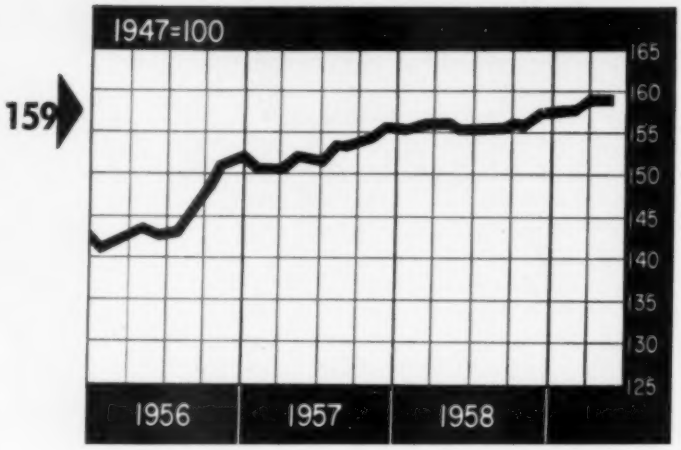
	MAY Estimated	APR Preliminary	MAR Revised	APR Year Ago
Total Index	**176**	**174**	**170**	**146**
Machinery	144	141	123	
Electrical Machinery	200	194	166	
Autos	133	132	86	
Other Transportation	353	338	336	
Other Metalworking	149	146	128	

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	MAY Estimated	APR Preliminary	MAY Revised	APR Year Ago
Total Index	**159.0**	**158.9**	**158.5**	**155.9**
Metalworking Machinery	**184.1**	**183.8**	**182.3**	
Other Machinery exc. Electrical	**169.6**	**169.8**	**166.0**	
Electrical Machinery	**159.3**	**159.4**	**157.5**	
Fabricated Metal Products	**148.8**	**148.7**	**146.6**	



Steady gains in output ahead...

Gross National Product for the first quarter of 1959 turned out to be slightly higher than anticipated. And because GNP is already past $470 billion, the second quarter rate, too, is likely to exceed earlier estimates that set it at a rate of $475 billion.

The added boost to GNP has come from heavy inventory buildup. Businessmen increased their stocks by more than $5 billion in the first three months of the year, with steel users' strike-hedging responsible for much of the buildup. But automakers have stepped up output in the face of rising demand, so that inventories of new cars have also been growing.

Business levels for second half 1959, however, should be pretty much in line with expectations, and GNP for the last three months of the year should be close to $486 billion annual rate.

Heavy inventory buildups should slacken during the last quarter of 1959 because (1) the steel strike will then be history, and (2) interest rates are rising and it is getting to be more costly to carry large stocks.

Rising interest rates will also make it more costly for consumers to buy on credit and to buy new homes—so even though consumers will continue to spend freely, they will think twice before going on a credit-buying spree.

There is still no indication that this Congress is made up of free spenders. And even though some appropriations have been greater than the President has asked, Congress on the whole has been careful in passing out public funds. And now that most talk about action on unemployment has been squelched by a sizable drop in the number of unemployed, deficit spending by the government is not likely to boost GNP to any extent. U S production, then, won't go into any big spurt this year. Rather, it will increase steadily.

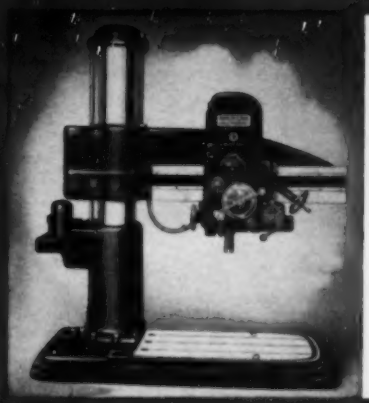
WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	152.3	151.9	123.2
Steel ingot operation (thousands of tons)	2,674	2,631	1,523
Electric power output (million Kilowatt hours)	12,684	12,659	11,257
Production of automobiles and trucks	172,325	170,993	113,998
Engineering construction awards (Eng. News-Record—millions)	$468.2	$415.6	$588.1

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	149	147	126
Index of durable manufactures production (1947-1949=100)*	164	160	131
Durable goods manufacturers' sales, millions*	$14,343	$13,870	$11,670
Machinery manufacturers' sales, millions*	$ 4,228	$ 4,131	$ 3,685
Durable goods manufacturers' new orders, millions	$15,149	$14,918	$11,488
Machinery manufacturers' new orders, millions	$ 4,802	$ 4,198	$ 3,511

* Seasonally adjusted

?

Are you really putting your small radial drills to work...OR... are they just drilling machines



If they are "AMERICAN" Hole Wizards they are DRILLING...TAPPING and BORING MACHINES

...not just radial drills!

To further improve their boring qualities the new "AMERICAN" 9 inch and 11 inch column Hole Wizards now may be equipped with a FINE FEED BORING ATTACHMENT.

This attachment, furnished in addition to the standard feeding mechanism, merely by the flip of a lever reduces the standard feed range 75 per cent.

The fine boring feeds thus provided are the answer to precision boring on radial drills. Many tool and die shops are already using them for high precision, fine finish boring of jigs and fixtures.

And don't overlook the advantages of the Hole Wizard's Helical Gear—Lo-Hung Spindle Drive —NITRIDED SPINDLE AND SLEEVE—TIMKEN MOUNTED WITH OUTSIDE ADJUSTMENT FOR SPINDLE BEARINGS.

These exclusive "AMERICAN" features permit putting your radial drills to work at a profit.

- ***Ask for bulletin No. 325 and get all the facts.***

THE AMERICAN TOOL WORKS CO. Cincinnati 8, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 349 READER SERVICE CARD

Another Tinnerman Savings Story...

Easier, faster, better, cheaper...4 reasons to use **SPEED GRIP**® Nut Retainers

Easier ... because anyone anywhere on the J. I. Case tractor production line can snap the spring steel retaining legs of the SPEED GRIP into punched panel holes. No special skill required. Hole alignment is no problem – the nut "floats" inside the cage to compensate for normal tolerances in the parts being assembled.

Faster ... no staking, no welding. No retapping of paint-clogged threads because SPEED GRIPS can be applied *after* painting. And they pop quickly and easily into position for final assembly.

Better ... heavy-duty SPEED GRIPS make possible sturdy, reliable attachments because both the cage and the nut are made of high quality steel. In case of accidental cross-threading, the SPEED GRIP can easily be replaced. You never have to "make do" with a sub-strength fastening.

Cheaper ... J. I. Case estimates a savings of about 30% per fastener over the previous method.

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American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

Getting Costs Where They Should Be

Almost every metalworking company will tell you that business is getting better. All signs point to further improvement ahead, with some temporary dislocation if a steel strike should occur.

But the rise in profits is not keeping pace with the rise in dollar volume. Competition is rough. And in many transactions, price is the determining factor.

This kind of situation . . .
easily contributes to many recriminations. The successful bidder immediately is labeled by his disgruntled competitors as "a price-cutter." But sometimes the price cutting has resulted from lower production costs and the ability to maintain comfortable profit margins at the successfully-quoted prices.

With manufacturers carefully sharpening their pencils to figure quotations on inquiries these days, the time never was more propitious to examine manufacturing costs. Increased business is a wonderful thing as long as you can make a reasonable profit on it. On the other hand, profitless prosperity is bad for everybody concerned.

Plenty of manufacturers . . .
are aware of the situation just described. And as the recent survey of the McGraw-Hill Department of Economics shows, they are going to do something about it. To be specific, they plan to spend considerably more money than they have lately for new plant and equipment.

More significant, the bulk of the investment will be put into replacement and modernization and not into expansion. This year, the automobile and auto parts industries will spend 90 cents out of every dollar of capital outlay to replace and to modernize. Industrial machinery manufacturers are allocating 68% of their capital expenditures for replacement and modernization. In the electrical machinery field the ratio is 58%.

What's more, as metalworking management looks beyond 1959 into the early 1960s, it becomes even more concerned about the need for keeping abreast of new production techniques. In those years even a larger share of the money put into new plant and equipment will find its way into modernizing and replacing existing equipment, according to present planning as revealed by the McGraw-Hill survey.

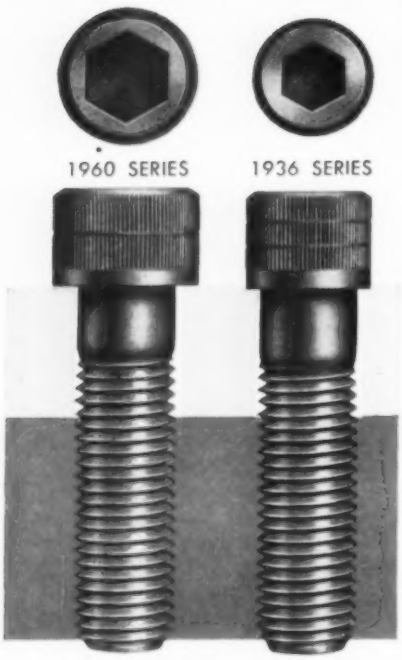
This shift in emphasis makes sense. It has been well stated by James H Goss, vice president of General Electric, who points out that General Electric has enough productive capacity for its requirements in the near future but intends to spend money on existing plants to help lower unit production costs and improve the company's competitive position.

To put it another way . . .
management's chief concern is with productivity. Its aim is to realize the most out of the available men, machinery, materials and their capabilities for producing goods. That is why its capital expenditures this year and the next few years will be mostly for replacement and modernization.

The point is that 1959 is a year in which to watch costs. It is a year in which to get your production costs down to a level enabling you to compete successfully in the market place for orders and then earn a satisfactory profit in filling them. Modernization and replacement of old equipment with new is one way of getting those costs down where they should be.

Burnham Finney EDITOR

Allen's *New '60 Series* Socket Head Cap Screws



give up to 2⅓ times more load carrying capacity ...without indentation!

In Allen's new '60 Series, head diameter of sizes from ¼" up is now uniformly one and one-half times the body diameter. In many sizes (where this ratio was not called for by 1936 Series specifications) this will provide *more* under-the-head bearing surface, and a proportionate *increase* in clamping force. Loads are more evenly distributed, and the greater bearing area in many cases eliminates need for washers.

Socket sizes have been increased in many cases—greater wrenching area permits higher tightening torque—which resists fatigue failure, and lengthens the life of the threaded joint.

- A new 2-band knurl will identify all ALLEN Cap Screws (except Stainless Steel) that conform to the new '60 Series specifications. New labels on boxes will also identify these.
- The 1936 Series of Allen Cap Screws will continue to be available.

COMPARISON OF ALLEN 1960 SERIES AND 1936 SERIES SOCKET HEAD CAP SCREWS

SCREW SIZE	HEAD DIAMETER Minimum (inches)		BEARING SURFACE Minimum (square inches)		PERCENT OF INCREASE IN BEARING SURFACE[1]	TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)		TORQUE INDUCED TENSILE LOAD TO INDENT IN SOFT STEEL[2] (lbs.)	
	1960 Series	1936 Series	1960 Series	1936 Series		1960 Series	1936 Series	1960 Series	1936 Series
¼	.365	.367	.044	.044	—	4,750	4,750	2,780	2,780
5/16	.457	.429	.070	.052	33	7,440	5,600	4,380	3,300
⅜	.550	.553	.111	.111	—	12,100	12,100	7,000	7,000
7/16	.642	.615	.140	.103	36	15,000	11,000	8,850	6,450
½	.735	.739	.183	.183	—	19,500	19,500	11,500	11,500
9/16	.921	.863	.293	.216	35	31,000	23,200	18,500	13,600
⅝	1.107	.987	.424	.224	89	45,000	24,000	26,700	14,100
¾	1.293	1.111	.585	.253	131	62,500	27,000	36,800	15,900
1	1.479	1.297	.768	.405	89	82,000	43,500	48,500	25,500

[1]Head tolerance revisions on Sizes #0 thru #10, ¼, ⅜, and ½ diameter have no significant effect on bearing surface or holding power of screws.
[2]Values based on .00025 inch indentation.

Ask your Industrial Distributor about ALLEN '60 Series Cap Screws. Write for samples and complete specifications. Ask for Bulletin G-25.

ALLEN MANUFACTURING COMPANY
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Stocked and sold by leading industrial distributors everywhere

ALLEN HEX-SOCKET SCREWS HEAD

Is US productivity misdirected?

Just where is all this constant striving for more and more productivity, more and more new products every year going to end? Economist Kenneth E Boulding of the University of Michigan asked that question at ASME's National Production Engineering Conference last month.

Answering his own question, Boulding said "Just because something can be done is no damned reason for doing it." Look, he said, at the upsurge in highway construction —"one day everything will be covered in concrete." Or take, he added, the current over-zealousness on the part of automotive designers, resulting "in an American car that is merely moveable costume jewelry."

A product, Boulding said, must satisfy some need or want—and utility is the ultimate product. In his opinion, today's engineer's tendency to get so close to the forest he can't see the trees may well result in an ultimate product of less utility than its predecessor. The American car is a case in point, he said.

Trouble with engineers, Boulding said, is that they're "sub-optimizers." In other words, they prefer to attack an overall problem as a group of small individual problems, arriving at a "best solution" for each. Using this method, engineers in Boulding's opinion as often as not arrive "at the right solution to the wrong problem" —the natural outcome of sub-optimizations breeding sub-optimizations.

"Professional corruptness"

"How do we prevent the solution of small problems from getting in the way of solving the large problem?" First, he suggested, we must feel the pulse of the market. But the market for new things isn't what it used to be. Because of this, Boulding said, production has become a sub-culture that manipulates the consumer to accept whatever is produced. "You might call it professional corruptness," he said. However, he does not blame the engineers, whom he calls "child-like innocents," but rather the marketing people.

Summing up, Boulding said, "We are spending money on gadget research . . . while many of our real wants are starving to death for lack of research."

We are putting our efforts into trivia, not essentials, he said, and we have lost our interest in beauty, as witness our new homes and buildings. "We do something for the sake of something else which is done for the sake of something else, etc," Boulding concluded, "and not for its own sake."

Total quality control

"Total quality control" is General Electric's name for a method that wraps up appraisal costs, failure costs and prevention costs into a neat, easy-to-analyze package. For instance, using TQC General Electric finds that out of every TQC dollar, 62¢ goes into failure costs, 28¢ into appraisal costs, and 6¢ into maintenance of patterns and tools. The remaining 4¢ goes into pure prevention.

As reported by GE Manufacturing Services VP H B Miller at the Conference, General Electric is concentrating on the prevention of defects, rather than pouring money into the correction of such defects after they occur. So successful has this preplanned "make it right the first time" program been at GE that quality control costs have dropped drastically as production increased markedly.

This does not mean however, Mr Miller said, that TQC involves 100% inspection. Too, TQC has been found to work equally well in high-production and job shops.

Measuring productivity

"Productivity" is a rather vague and all-embracing term. Just what it is, how it can be measured, and some trends that have shown up over the last 60 or 70 years were explained by George Washington University economist John W Kendrick.

"Output," he said, "must be related to four factors—labor, capital, materials and technology—to make sure that there has been an increase in productive efficiency."

The difference in tangible input and output, he continued, lies in know-how. To management he advised, "You must keep productivity at least at the industry average. Otherwise over the long run profit will go down . . . Sales tricks, market edges and the like will only go so far."

Speaking before ASME's National Production Engineering Conference in Detroit last month, Kendrick pointed out that outputs and inputs must be matched, or at least related. Whatever items are kept on the input list, he said, outputs corresponding to them must be kept on that list, too.

Odd production units must be reduced to a common denominator, and the best way to do this is on a basis of output less excise taxes and the price of inputs.

Input price of labor, Kendrick said, should be based upon actual hours worked, not hours paid to give a higher indicated output. And prices must be measured in constant dollars. In other words, a base dollar value (say 1950 dollars) must be established and this should be used for both input and output.

"Consumers," Kendrick said, "tend to shift their buying to those items which haven't risen so much in price" —therefore any price index figures used should be re-evaluated every 10 years or so.

Speaking on trends in productivity, Kendrick said that the rate of productivity has increased at a steady 2.1% per year since WW I. That's the overall figure, but within that framework productivity has increased 5% for utilities, 4% for chemicals, on down to lower-than-average rates for leather and building construction trades.

One thing that will aid productivity, Kendrick said, is a tax reform that would allow industry to "charge as a cost the going rate of interest on its equity capital."

. . . and the last word

"Productivity Viewed from the Outside" was the intriguing Conference topic presented by Reverend Scott Paradise of the Detroit Industrial Mission. Productivity, more particularly increasing productivity, he said, is "a good and moral thing." Why? "We think that an increase in productivity is somehow linked with more material wealth, leisure and thus happiness . . . the step is then from productivity to good . . . Workers are human and productivity is for their sake, and not they for its sake.

"But the reckless misuse of this planet's resources for trivial things is indeed a mistake," Reverend Paradise concluded.

Don't be penny-wise and pound-foolish if you want to . . .

Make *your* capital investment pay off

With the current trend away from simple tools and much labor to complex tools and less labor, the race will go not to those shops whose facilities are the most costly, but to those whose facilities are best fitted to their needs. Consequently, each year it is becoming more and more difficult to buy the right machines for the right job. And automation accelerates this trend: one man operates more costly machinery, and the risks of obsolescence increase.

That's the opinion of General Electric's W W Kuyper, expressed last month in a talk before the AIEE-ASME-IRE Automatic Techniques Conference in Chicago.

Said Kuyper, "Too many of our facilities seem to have been the result of a continuing push-o-war between a top financial man and a shop superintendent.

"The financial man yields only when the pressures on the superintendent produce in him the zeal of a crusader in selling his cause. . . . The result is all too often a run down, overworked shop, or a beautiful aggregation of tools only partially at work."

A successful business, Kuyper added, must do a better job of capital goods buying than this balancing of personal forces. Three principles must apply, he said, to the purchase of new plant and equipment:

- The course of action chosen must be the best possible.
- Where possible, purchase of each machine, piece of equipment or accessory must be justifiable.
- Projected cash flow (initial outlay plus upkeep) must be low enough to maintain a favorable rate of return on the investment.

Picking the right machine, Kuyper said, is today like trying to pick the winner in a race where each horse runs a different distance, starts at a different place and has a different handicap.

For example he cited a case wherein a load analyst recommends that a new 1-in. bar turret lathe be bought to increase production in a small parts producing shop.

First, several makes of turret lathes and choices of attachments have to be considered. Then come some other alternatives based on close study of the job: Is there enough work to make a tracer attachment worthwhile? If so, would a 2-in. machine be more desirable? Or are lot sizes large enough to justify the use of one or two new single-spindle bar automatics — operated singly or in pairs?

Is part of the load such that it should be bought from a specialty or parts manufacturer? Can or will designs be changed so as to make the machine obsolete?

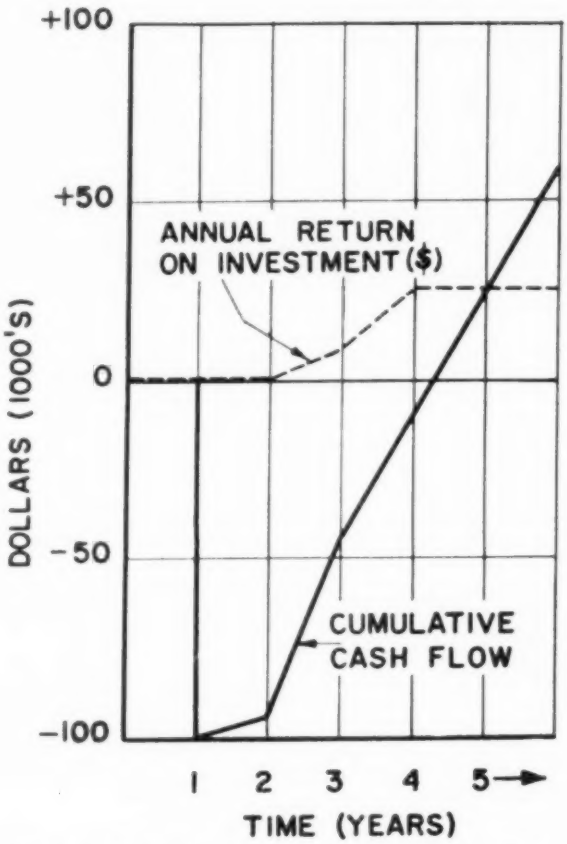
Complex? Yes. But a business "cannot afford to be second best in its ability to produce at minimum cost," Kuyper told the Conference, " . . . in the words of a successful builder 'add the last 5%, which sells the other 95%.' "

This principle applies, Kuyper said, whether it is in the purchase of 50 versus 100 footcandle lighting for the drafting room, or whether or not to install a spacer table under a radial drill.

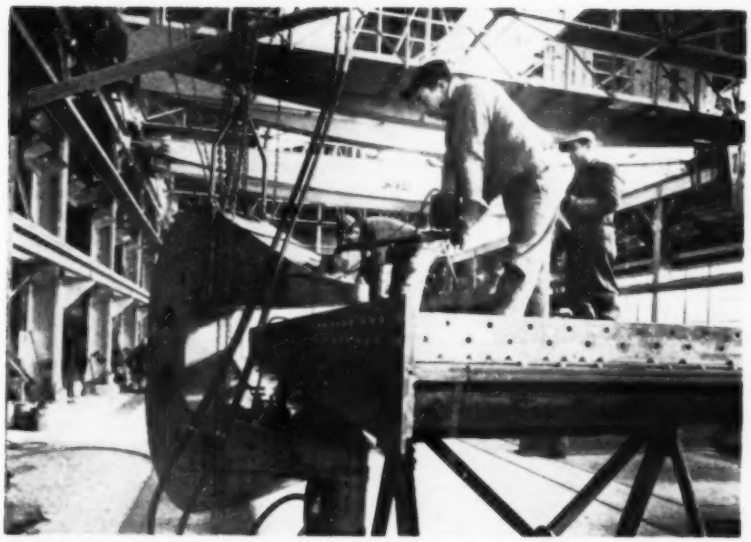
In other words, a small additional outlay for a machine tool accessory often pays off in a big gain in productivity. Too, Kuyper said, on heavy capital equipment the labor savings factor is negligible compared with the percentage of base cost.

For instance, a $3000 jib crane for handling tools over a $300,000 horizontal boring machine need save only 1% of the machine's operating time (in waiting for overhead cranes) to justify its cost of installation. To that saving could be added 1% of the cost of operating the crane.

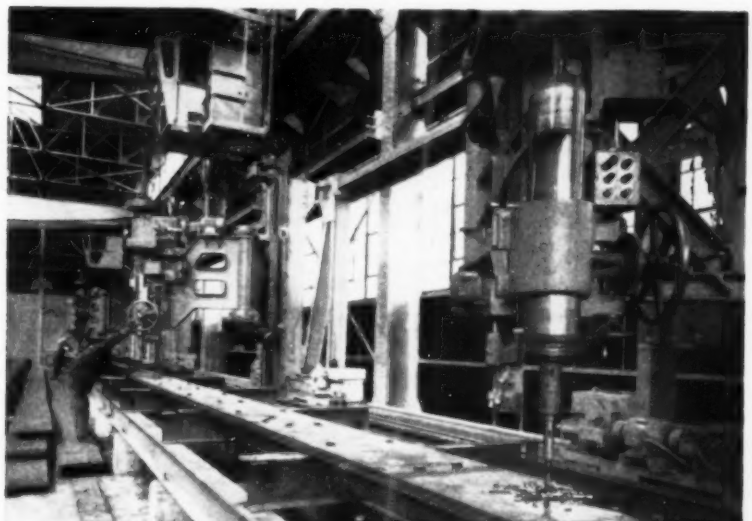
For costly equipment it is of major importance that all details of the proposed operation be examined exhaustively, Kuyper said, to insure that all practicable accessories have been added for maximum output.



Typical cash flow and net return on investment for a given piece of new metalworking equipment



Tight Rivets Driven Faster—The hydraulic bull riveter will drive 20-25 rivets per min. in sizes up to 1¾ dia (hot). Riveter is carried on a traveling jib crane, is faster than conventional pneumatic riveting



Cover Wide Area—Three Baush radial drills, each mounted on its own wall crane, permit the drilling of bridge-girder plates 9 ft. wide by 46 ft. long, or chord assemblies, as shown, without moving the piece

Steel Fabricator Modernizes for Growing Market

New machines, new buildings, plus better facilities for materials handling and labor's comfort should enable a well-known steel fabricator to push into growing markets.

Steel remains the lightest, most proved material for the framework of industrial and commercial buildings, schools, and bridges. Fabrication of steel members for these structures is not a static business, either from the standpoint of volume or engineering change. Those who would keep on top in this highly competitive business must set their houses in order during a lull period.

A good case study of forward planning lies in the modernization and expansion program of Bethlehem Fabricators, Inc., Bethlehem, Pa. This concern has just completed the first overhaul of its facilities—based on forward planning—in more than 38 years of existence. Any prior improvements were dictated by the needs of the moment, not from an analysis of what logically lies ahead. Here is what Bethlehem Fabricators got for $750,000:

Capacity Increase—42%, from 35,000 to 50,000 tons per year.

New Girder Shop—a "mass production" shop for bridge girders up to 150 ft long, as needed for the expanding highway program. Plate girders weigh up to 50 tons, have a height of 10 ft. Lattice girders are also assembled.

Material is unloaded from cars directly into one end of the girder shop. Along one side of the building are three Baush double-arm, radial drills, each carried by a wall crane. The center section of the building is used for fit up. A crane with a 25-ft reach, to carry a 4300-lb hydraulic riveter and rivet heater, is installed on the other long wall. The 72-in. riveting bull will drive 20-25 (up to 1¾ dia hot) rivets per min., or twice as many as was possible previously.

The crane operator also heats rivets, using a Cheston electric heater (five 3-step electrodes), and tosses them to a catcher working with a riveter manipulator on top of each girder. Underneath the assembly, which rests on man-high steel horses, the chief riveter adjusts the rivet set to the work and pushes a switch controlling hydraulic pressure.

The girder shop has two 25-ton overhead traveling cranes.

Warmth in Open Buildings

In steel fabricating plants, the ends of buildings are usually always open to allow easy crane access to material in storage yards. The result is fearfully cold and drafty working conditions in winter. Much time is lost in lighting salamanders and huddling around them for warmth.

A system to provide heat for production workers, in seven buildings, involves use of 290 gas-operated infra-red heaters. Rows of these heaters are spotted overhead to heat busy areas. Infra-red rays warm only the objects they touch—employees, machinery, tools, floors and structural steel in their path. Any additional fuel costs are more than made up by the savings in man-hours attributed to the new heating system.

Weed out errors to get better centerless grinding

If quality is good enough to allow sampling inspection, you have reached tight control over tolerances and scrap. This goal can't be reached, though, unless you recognize and eliminate sources of error in machine, gaging device and operational procedures. Here's the way to analyze the problem

By William E Wackenhuth, professional engineer

Many companies have installed automatic size-control devices on centerless through-feed grinders. These additions have been made chiefly on a basis of expected savings in operating costs through better use of labor.

What are other savings? A by-product of better control is improved quality—and a bonus in the form of scrap reduction. Herein may be an area for still further investigation for savings by the adoption of even better equipment and controls. A closer study would probably reveal the fact that a further reduction in the normal scrap rate would not justify the expenditure for better equipment, unless the savings could be carried into the inspection area by the adoption of a sampling plan in place of 100% final inspection.

With this goal then in mind, let us analyze the problems involved in grinding to close tolerances by endeavoring to fix responsibility for the various errors in dimensional output of the machine. We may then assign specific allowable tolerances to these errors. This can best be done by considering a typical high-volume through-feed grinding problem.

A manufacturer through feeds small, hardened-steel pins at a rate of approximately 600 ipm. His day-to-day tolerance spread over a period of one month on a two-shift basis is in the order of 0.00025 in. The grinders are equipped with automatic size-control devices on both the roughing and the finishing machines. Management recognizes the possibility of close-tolerance grinding, would like to reduce the actual tolerance to 0.0001 in. Stated another way, management requests a quality improvement of 250%.

It may appear to you that an actual tolerance of 0.00025 in. is not close. The finish grinders actually hold a tolerance of as little as 0.000050 in. for periods of an hour, and the entire tolerance spread for an 8-hr shift occasionally reaches a low of 0.000075 in. It makes a great difference whether we compare size performance for short periods or a longer time—say, 48 hr—and, in addition, we include output of several men.

Basically the problem resolves itself about three salient points:

1. Machines which are capable of grinding on a long-term, day-to-day basis with a total tolerance spread within 0.0001 in.
2. Controls which are capable of locking in the dimensional output of these machines to maintain this 0.0001 in. spread.
3. Education of operating personnel in the proper use and care of the equipment, as well as a thorough indoctrination in the quality concept.

At this point, we should list the various factors that contribute to the over-all size deviation of the work from an automatic grinder of the type considered. These causes are tabulated according to:

Errors Attributable to Machine:

1. Natural piece-to-piece variation, or scatter, of the machine output.
2. Variations in feed rate due to variations in work flow from the feeder, jams, etc. Changes in feed rate cause variations in grinding pressures, which, in turn, vary the spacing between the wheels and, of course, the size. This condition is known as machine "breathing."
3. Loading of the wheel.
4. Breakdown of the wheel.

Errors Attributable to Machine Controls:

1. Inaccuracy of automatic gage readings from poor repeatability.
2. Dimensional size drift inherent in the automatic gage, as well as drift due to temperature changes.
3. Inability of the size-correcting mechanism to track with the dictates of the gage.

Errors Attributable to Operation:

1. Error in the set operating point (zero size) of the automatic gage to coincide with the fixed hand gage.
2. Improper automatic-gage-con-

Analysis of Fixed Errors in Machine

	Original Analysis	Re-assigned Values
Machine scatter— piece to piece variation	.000030 in.	0.000010 in.
Discrepancies of the set-up masters— due to incorrect size marking, temperature variations, wear, etc.	0.000015 in.	.000010 in.
Discrepancies in the gaging equipment— due to drift, discrepancy between actual piece-part size and the reading on the automatic gage, discrepancy between the automatic control gage and the hand checking gage.	0.000020 in.	.000010 in.
Discrepancy of the size-correcting mechanism— to follow the dictates of the automatic control gage	not known	.000010 in.
Total	0.000065 in.	0.000040 in.

trol set points, and or, improper amplification of the gage.

3. Frequent readjustment of the operating set point.

4. Dimensional error in the size of the set-up masters used to calibrate both the automatic and hand gages.

5. Parallax in reading the automatic and the hand gages.

6. Condition of the work blade.

7. Improper setup of the entrance and the exit guides of the machine.

8. Improper alignment of the work flow through the machine and the automatic gage.

9. Out-of-round work due to improper setup.

10. Improper grinding, and or, regulating wheel for the particular work.

11. Improper dress-off of wheels or failure to dress wheels as needed.

It will be noticed that the greatest number of causes of size variation is attributed to operating personnel. Each of the tabulated items contributes its portion of inaccuracy to the product, but, the total of all these inaccuracies must not exceed one hundred millionths of an inch (0.000100 in.).

Each machine contributes its own inherent inaccuracies to the product. These inaccuracies are usually fixed for a particular machine but differ slightly from one machine to another. These fixed errors are itemized in an accompanying table.

If we subtract this total error from the actual grinding tolerance we get 0.000100 –0.000065 = 0.000035 in. total allowance for all other variables, such as wear of work blade, deterioration of regulating and grinding wheels, misalignment in set-up, etc, and in addition, the above mentioned item—"discrepancy of the size correcting mechanism to follow the dictates of the gage." We do not have leeway to insure a good risk.

As outlined thus far our objective cannot be accomplished under the above conditions of allowable error as it exists in the present equipment. It is necessary to revise downward the allowable fixed errors to satisfy, or approach, our goal. In other words, we must assign new maximums for each major cause of error, and make the equipment conform to this target. Re-assigned values are likewise tabulated. Their sum subtracted from the grinding tolerance is 0.0001000 – 0.000040 = 0.000060 in total for all other variables. This figure is in the realm of reality.

It has been shown that it is a practical possibility to achieve and to maintain a grinding deviation of not more than one hundred millionths of an inch over a long period of time, providing improvement is made in the three areas considered. The responsibility for achieving this goal rests with two groups: equipment builders and users.

Specifically, the machine builder must recognize and correct the following items:

1. Improve the performance of his machine in such manner as to insure the machine capability well within the 0.000010 in. deviation allowance.

2. Recognize the fact in "deed as well as thought" that the size-correcting mechanism attached to his basic machine becomes a part of the basic machine, and as such, must be *his responsibility*. He must, therefore, work in close cooperation with the gage builder. To date, much improvement can be made in this direction.

The gage builders as a group are reticent regarding the capabilities of their product. To say that, "gage drift over an 8-hr period is negligible," is meaningless. It is the responsibility of the gage builder to make known to the buyer:

1. Specifically what is the maximum gaging error due to hysteresis?

2. What is the maximum error due to drift over an 8-hr day?

3. What is the maximum error due to the shifting of control points during this 8-hr day?

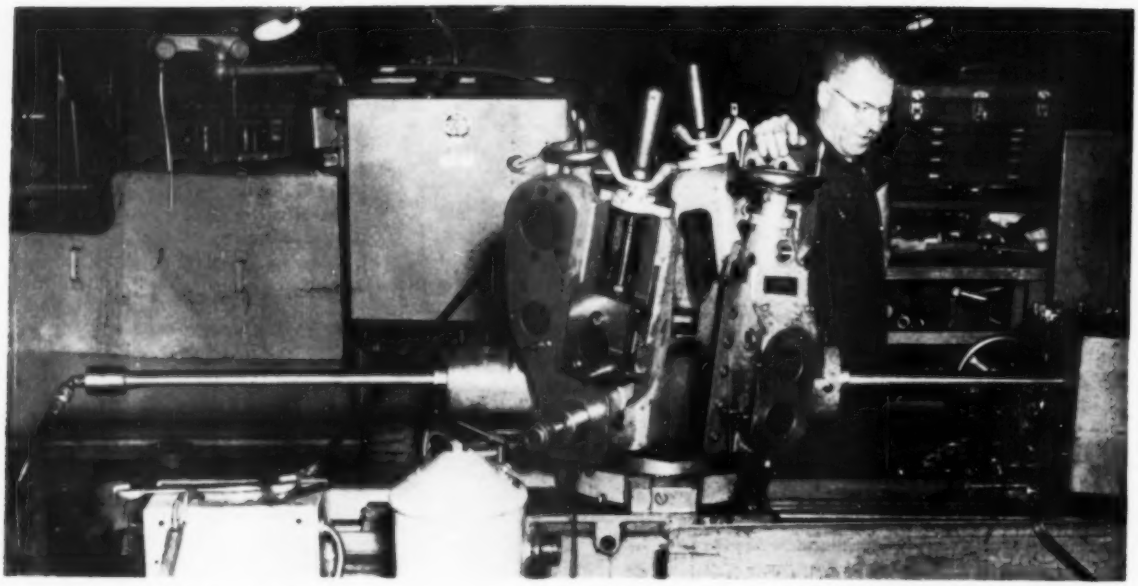
4. Do the gaging capabilities fall within the allowable 0.000010-in.?

It is the joint responsibility of the machine builder and the gage builder to limit the discrepancy of the size-correcting mechanism to follow the dictates of the automatic control gage to the allowable 0.000010 in.

If the installed equipment does meet all of the specifications outlined, achievement of the stated goal becomes the responsibility of the operating personnel. Now, it is necessary to regulate the process to insure and maintain success. This can only be done through education and re-education of all operating personnel, including the foreman.

Taking up the leeway on a keyway

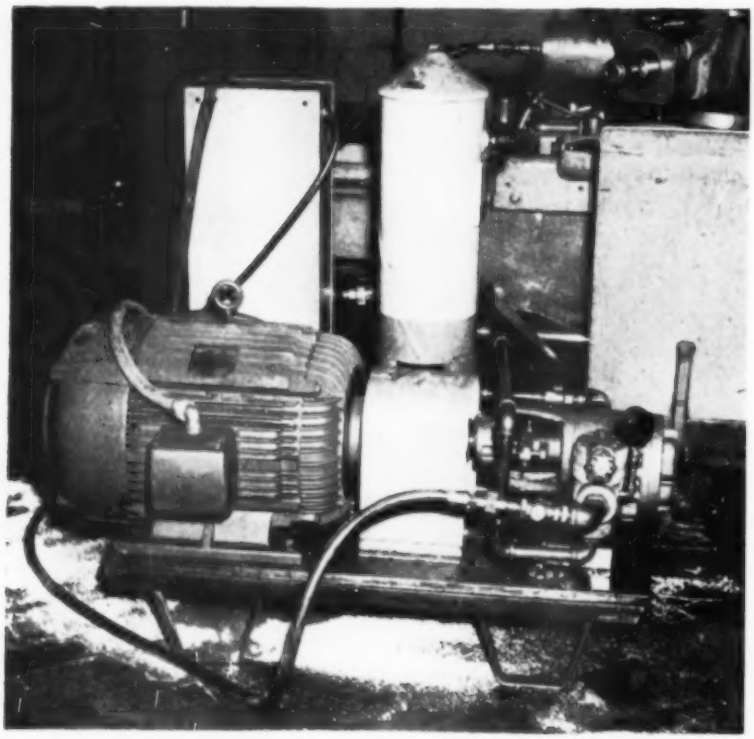
San Francisco Naval Shipyard ran up against a tough problem recently—machining a keyway in each of two massive rudders. Part of the 3.5-in. keyway paralleled the bore centerline, the rest followed the wall of taper. The shipyard's Morton drawcut milling and drilling machine was too large to do such a delicate job, so the Heavy Tools Section designed and produced an adapter "for concentrated angle milling in a restricted area" in just three weeks. The adapter enabled power to be carried to a conventional angle milling attachment without loss of lateral strength



Gun drill works in turret lathe . . .
to produce holes 60 in. long in forged steel spindles. Drill tube is twice as long as gun drill because turret stroke is short, and drill must be advanced, then reclamped to feed to full depth

Portable power makes gun drills

By Hans F Krell, supervisor, methods & tool design,
G & L Hypro Div, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis



Pumping unit supplies oil . . .
for gun drilling at either turret lathe. Pump, motor, valves, and all accessories are mounted on standard 24 x 42-in. skid

A portable hydraulic unit helps modified turret lathes add gun drilling to their usual routine of standard operations. The special accessory provides pressure to flush chips out of gun-drilled holes in forged-steel spindles for machine tools.

Both lathes are saddle types: one a 7-A Jones & Lamson with a 4½-in. spindle bore and spindle speeds up to 1000 rpm; the other a 3-A Warner & Swasey with a 6-in. spindle and speeds to 628 rpm. Both have been fitted with separate worm-and-gear reduction units that produce drilling feed rates of 0.0015 to 0.002 ipr—to make fine chips that will flush through the drills.

Gun drills are applied for 1-, 1¼-, and 1½-in. holes in spindles up to 60 in. long because tests prove that gun drilling is faster and more accurate than conventional spade drilling. Gun drills penetrate at ¾ to 2 ipm with cutting speeds of 160 to 390 fpm, depending on drill size and machine capacity.

The pumping unit, which was built in the shop for about $1200, delivers cutting oil at pressures up to 800 psi, though 200-300 psi is usually sufficient. The skid carries a 25-gpm pump, Honan-Crane filter, Vickers relief valve, a 1000-psi pressure gage, magnetic starter, and hose.

Worm-and-wheel reduction gears . . .
are mounted with motor on machine bed to produce slow feed rate. Equipment is removed when regular lathe operations are required

# of turret lathes

Milling-machine spindles are gun-drilled . . .
of turret lathes. The heat-treated forgings have been skim-turned

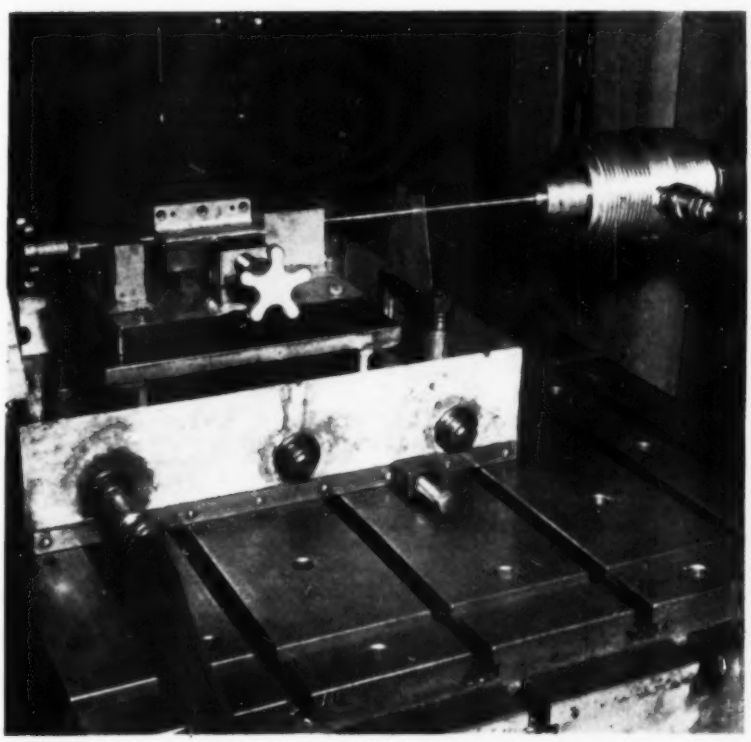
Heat-treated and rough-turned spindles of AISI 4140 and 4145 at hardness ratings of 28-32 R_c, and heat-treated and stress-relieved Nitralloy-G spindles at 207-241 Bhn are drilled.

Gun drills for cast iron

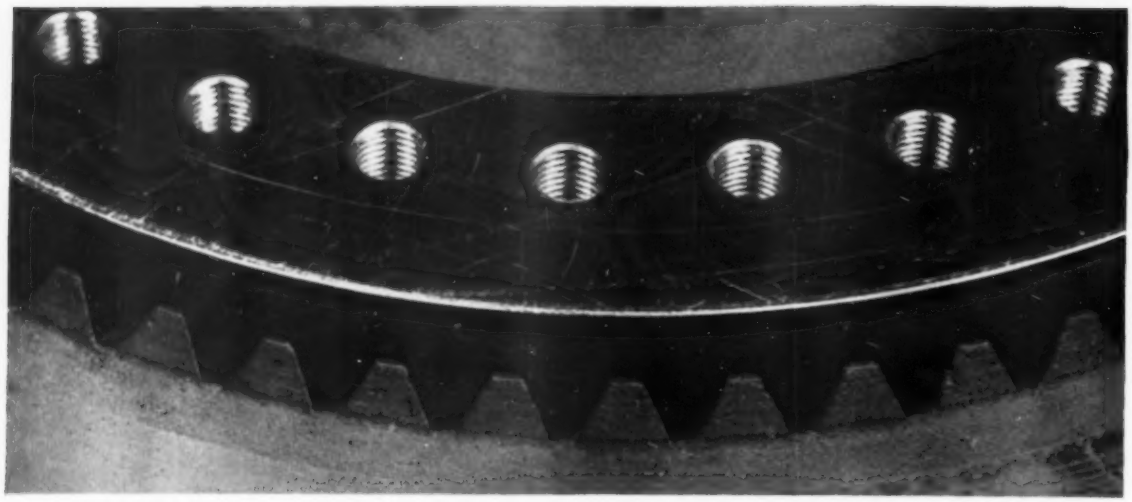
Economies on the steel spindles led to gun drills for small CI and steel brackets, which are machined on a 300-T Giddings & Lewis horizontal boring, drilling, and milling machine. The fixture will accommodate 18 different parts, and is positioned inside a hinged hood that prevents coolant and chips from spraying around the shop. At the base of the hood a leak-proof pan drains cutting fluid to a 36-gallon floor-level tank.

Coolant is supplied by the portable pumping unit built for the turret lathes, or by a similar skid-mounted unit with a 10-gpm Vickers pump and 10-hp motor.

Coolant enters the machine from a flexible hose and through a Sealol non-rotating fluid-transfer coupling on the machine spindle. The gun drill rotates at 1600 rpm and feeds at 2.5 ipm to cut holes 0.4375-0.4380 in. in dia. and 4⅛ in. long. Surface finish and accuracy are good enough that two hours of lapping time has been eliminated.



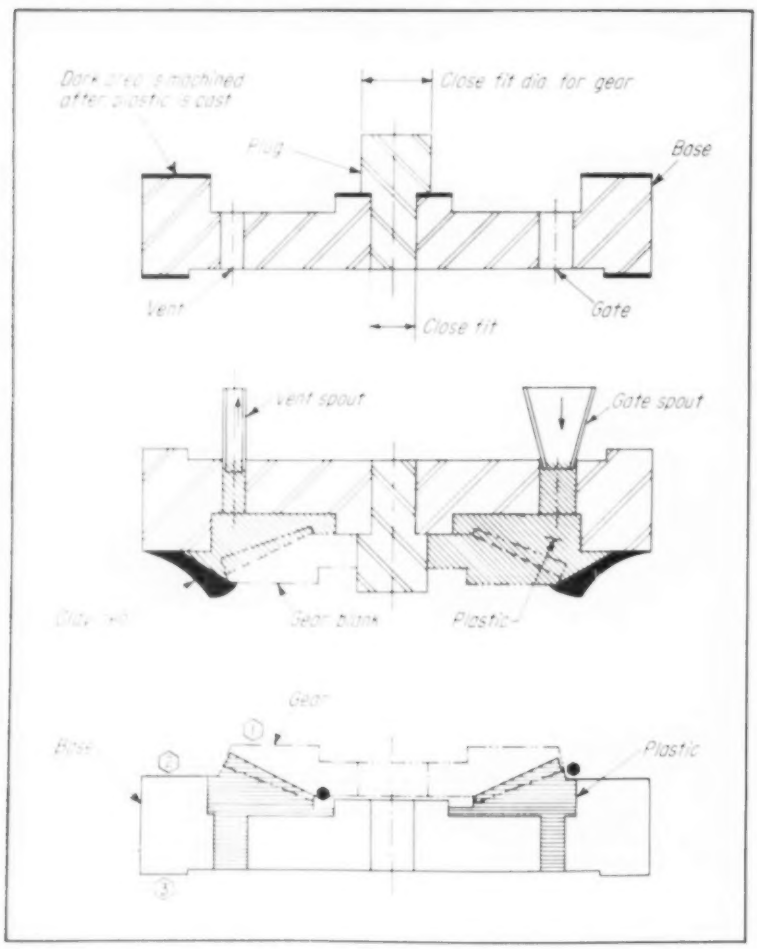
Gun drills also work . . .
on horizontal boring, drilling, and milling machine. Splash hood has been removed here



Pitch-line chuck . . . mounts gears with clearance at crests and roots, making gear support by tooth faces only

Plastic makes helicopter gears more accurate

By W J Cassady, gear-development engineer, and
J T Tullous, plastics development engineer, Bell Helicopter Corp, Ft Worth



Iron-filled epoxy resin is a good material for a workholding fixture because it is hard, strong, stable—and especially because it is easy to form. This gear chuck was built by casting the resin against the tooth face of a prototype gear, which produced accurate reverse tooth forms that required little subsequent machining.

The fixture is required because these spiral bevel ring gears must be finish ground both on tooth faces and backs to remove heat-treat distortion. The cast fixture with built-in tooth shapes is to mount production gears so their backs can be equalized. This will leave a minimum amount of grind stock for the final operation on the tooth face in a Gleason grinder. The fixture is in reality a pitch-line chuck that supports the gears for a back-grinding operation.

After a cast-iron base was machined to admit a central work-locating plug, the pattern gear was mounted, and the gaps between were sealed off with clay. Parting agent was added because the plastic adheres strongly to metal. The plastic (Epocast 11B) was poured, then allowed to cure for 72 hr.

Cleanup machining was necessary to remove plastic adhering to the pattern gear, and to cut clearance areas at tooth ends—but leaving at least 70% of each tooth length. Tooth

Cast-iron base is machined . . . and a plug is fitted to center the gear. Clay seals off gap between base and pattern gear; then epoxy is poured

machining is required only if a production gear acts as pattern. A special gear with addendum 0.01-0.02 in. oversize can act as a pattern, and will leave root clearance that throws all support on the tooth faces.

Production gears usually rock when they are mounted on the fixture, but if rock is less than 0.004 in., they can be clamped and ground. Distortion over this limit means the gears must be returned to heat-treat for reprocessing.

Results with the fixture have been good—including a 40% reduction in tool-preparation cost. Production gears are ground to remove as little as 0.002 in. of stock on the subsequent Gleason operation, proving that gear-back grinding is effective.

Gear chuck . . . holds production gears for final grind on back mounting surface. Gear is lightly built; fixture must nest it with minimum rock so clamps will not distort it

Albert Hauptli retires after 14 years as publisher of American Machinist

Albert Hauptli is retiring as publisher of AMERICAN MACHINIST and George Reppert is replacing him. The change is effective with this issue.

It was just fifty years ago that Albert Hauptli took his first job in the publishing business—and that, too, was with a magazine known as *AM*. It was a summer job with the old *American Magazine* as a copy chaser and assistant to the advertising make-up.

After graduation from Phillips Exeter Academy and study at Columbia University (with summer after summer spent in some phase of publishing), Mr Hauptli became a full-time advertising space salesman. After brief stints with other publications, he joined the McGraw-Hill Publishing Co in 1920 to represent *Electrical World* in the Chicago territory.

In 1939, Mr Hauptli was made associate district manager of the Western District. His outstanding success in that position led to his appointment as publisher of AMERICAN MACHINIST and *Product Engineering* in 1945.

During the nearly 14 years that he has been publisher, AMERICAN MACHINIST has expanded its service to readers and there has been substantial growth in both circulation and advertising. The editors have continuously had his staunch backing and the 14-year relationship has been a happy and fruitful one.

Following his retirement this week, Mr Hauptli plans a short vacation before announcing his future plans.

George Reppert, the new publisher, came to AMERICAN MACHINIST after several years with Safway Steel Products, Inc. A graduate of Princeton University, Mr Reppert spent five years in the Field Artillery during World War II, enlisting as a private and being discharged as a lieutenant colonel after service in the Southwest Pacific area, New Guinea, and Japan.

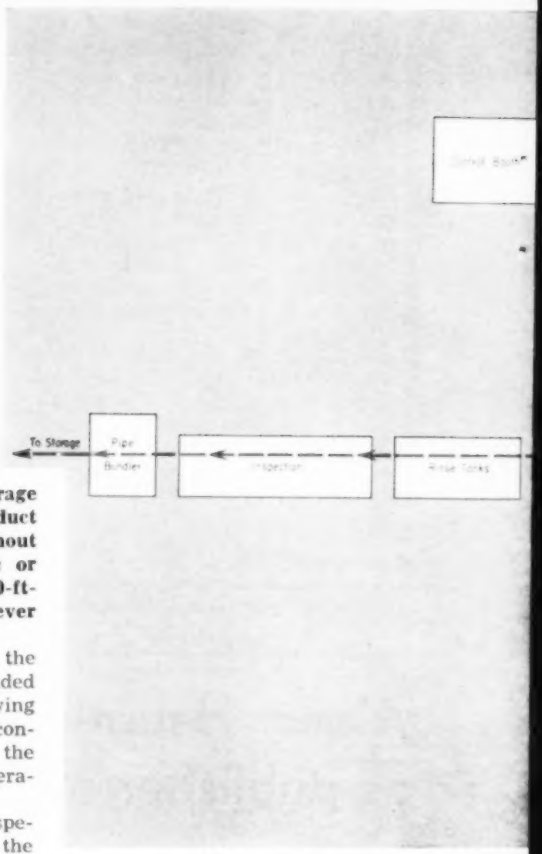
Mr Reppert joined AMERICAN MACHINIST in 1949 and was made advertising sales manager in 1953.

AMERICAN MACHINIST's editorial policy will continue unchanged—to provide full and timely coverage of new developments in metalworking manufacturing.

Albert Hauptli

George Reppert

Automated setup hot-galvanizes steel pipe



An automatic hot-galvanizing machine, controlled by only one man in an adjacent booth, is now in full operation at the new plant of Pittsburgh Standard Conduit Co in Verona, Pa. This special machine, along with improved techniques for moving hard-to-handle pipe before and after galvanizing, has enabled the company to boost production of electrical-conduit pipe more than 25%. At the same time, labor force in the new plant is only half that in the old.

Designed by PSC Vice President for Production James M Young, and built in the plant, the machine is unique. With it, the company can make electrical conduit in a way that differs sharply, in one important respect, from traditional pipe finishing: **Here the pipe is threaded *before* galvanizing, not after.**

To coat the threads and the pipes in the same operation, the machine uses wiping rings, superheated steam, compressed air, and ingenious handling devices. All these elements function to keep the molten zinc evenly coated on the pipe—not only on the walls but also on the threads, not piled up in thread valleys. The result is a better product, more quickly and efficiently made because the usual separate process to galvanize the threads is unnecessary.

The hot - galvanizing machine, which accommodates steel pipe ranging from ½ to 6 in. in diameter, is the most striking feature of the new plant. But the company also is set up to galvanize conduit by electrodeposition, and makes all the standard conduit fittings. A recent addition to the product line, aluminum conduit, is being turned out in smaller quantities.

Pre-Galvanizing Operations

Production of hot-galvanized pipe is in-line (see sketch). Raw pipe stock comes in from outside storage at one end and the finished product comes out at the other. Throughout the entire operation, automatic or semi-automatic handling of the 10-ft-long pipe has been built in wherever possible.

Raw pipe stock moves into the plant on pipe cars, which are loaded outside by a fork truck. Moving along rails to line up with a conveyor table, the cars position the pipe for the first machining operation: cutting the pipe to length.

An automatic two-blade saw, specially designed and built at the plant, does the cutoff operation. Incoming stock moves from the pipe car onto a roller conveyor that feeds the pipes—one at a time—into the machine. As a piece of pipe approaches the machine, both ends drop into notches in revolving wheels, and the pipe, supported by the wheels, is rotated into position for cutoff. Positioning of the pipe, and sawing off both ends, are automatic. And because the wheels that feed the pipe have four sets of notches, each set carrying a pipe, a steady supply to the saws is assured.

Once the pipe ends have been cut off, the pipe is automatically ejected and fed to a conveyor that sends it to a double-end threading machine. This Davis & Thompson machine, extensively remodeled to suit the plant's requirements, cuts a thread in both ends of the pipe. The machine will hold six pipes at a time, and operation here (as with the saws) is continuous.

Next stop, after the pipes have been cut to length and threaded, is the pickling department. Here batches of pipe, supported by slings from an overhead crane, move through several chemical and rinse baths. Last operation in the pickling department is to dip the pipes in a pre-flux of zinc-ammonium chlorate, which deposits a film that facilitates galvanizing.

Galvanizing the Pipes

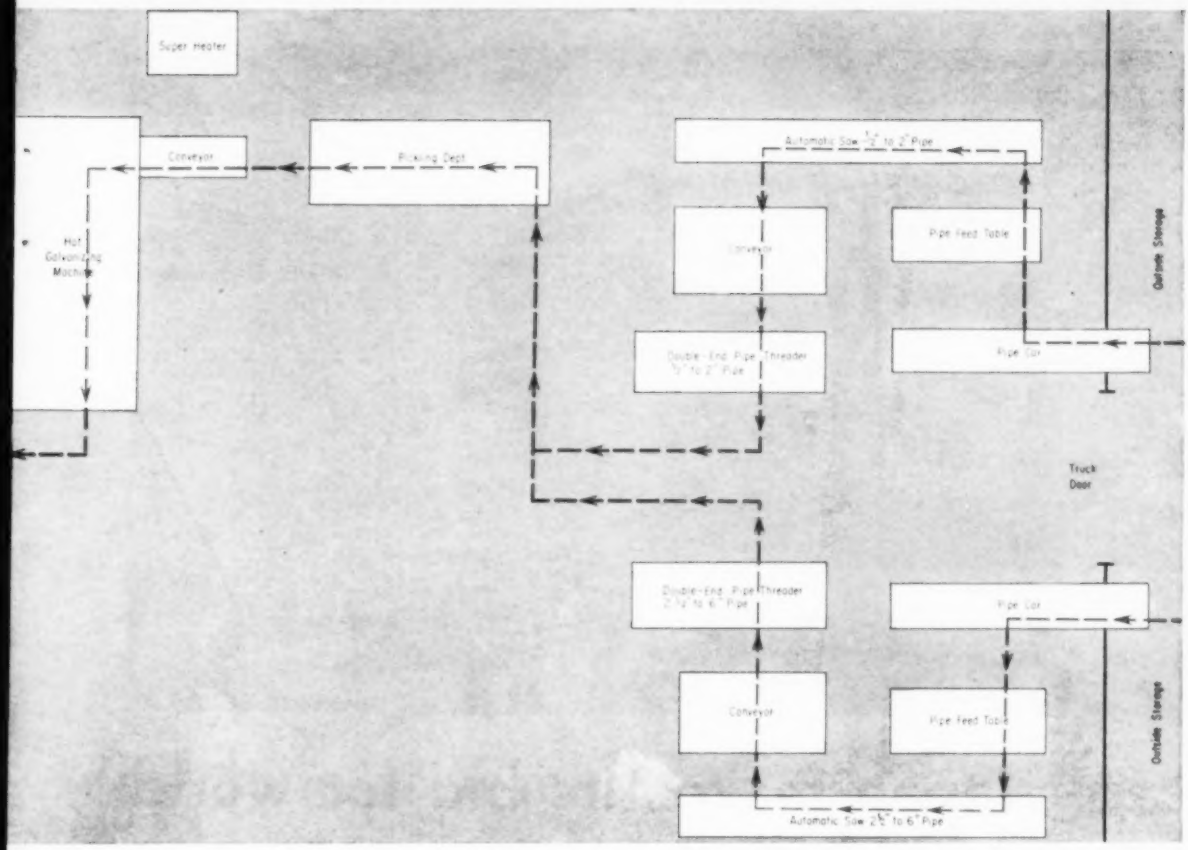
Pipes enter the hot-galvanizing machine on a chain conveyor, and are immersed in molten zinc (860 F) for a specified time, depending on pipe size. **Once the pipe enters the machine, all galvanizing processes are automatic, controlled by one man in a nearby booth. Formerly, it took six men to handle this operation.**

Here's what happens to each pipe when it enters the machine:

1. As the pipe drops into the molten zinc, or spelter, each end is pushed down onto notches in large wheels, which then rotate, carrying the pipe through the molten bath. To prevent pipes from falling out of the notches, a stirrup surrounds the lower halves of the wheels.

2. At the end of the cycle (when the pipe has been rotated about 270°), the pipe is picked off the wheels by a hook that lifts it to magnetic rolls. These rolls engage the pipe and carry it from the zinc bath.

3. Now the magnetic rolls shoot



the pipe through a steel wiping ring that removes excess zinc from the exterior. Superheated steam, passed through slots in the ring, is the agent that wipes off this excess metal.

4. After passing through the wiping ring, the forward end of the pipe trips a flag switch, causing the pipe to drop into a set of grips. Simultaneously, the pipe breaks a light beam that energizes a set of timing relays; these cause a blow nozzle to advance to the forward end of the pipe. Now superheated steam is blown through the pipe, to clean off excess metal on the interior wall. After a given time, the steam is turned off, the nozzle is retracted, the grips that hold the pipe are opened, and the pipe falls onto an exit conveyor.

While all the above operations are going on, still another takes place: Once the pipe is firmly positioned in the grips, burners automatically come on to keep the threads at each end covered with flame. Purpose here is to keep the zinc on the threads in a molten state until the next operation.

5. When the pipe reaches a certain point on the exit conveyor, it breaks another light beam that turns on a second wiping ring. As the pipe passes through this ring, the threads at each end are cleaned with compressed air, so that the molten zinc is evenly distributed over them.

6. Now the pipe goes onto a chain conveyor that air-cools it down to about 500 F. Then it drops into a quench tank.

7. Final step is to immerse the pipe in a chromate solution. Here the solution combines chemically with the zinc to form zinc chromate on the exterior and interior walls. This surface inhibits white rust and increases salt-spray resistance of the pipe up to eight times.

During all the operations described above, one man controls all phases of pipe finishing. From his booth he can vary the following requirements:

- Speed of the pipe's rotation through the molten zinc
- Temperature and pressure of the steam
- Temperature of the molten zinc
- Immersion time
- Rate of withdrawal on the magnetic rolls
- Length of the interior blow
- Temperature of quench water
- Immersion time in the chromate solution

Some measure of the machine's complexity is apparent in the following figures: There are 28 sequencing switches, 15 timing relays, 4 automatic reversing switches, 28 solenoid-operated valves, and 3 variable-speed drives.

The Final Product

Once the pipe has a zinc-chromate coating, it is carried through cold-rinse and hot-rinse water tanks (the latter rinse facilitates drying). Then it rolls onto a conveyor that takes it through the following operations:

1. Inspectors examine the pipe. At one end, an inspector screws on a straight coupling; at the other end, a man places a plastic protective cap over the threads.

2. The pipe passes under a marking machine, which automatically rolls on the company's trademark.

3. At the end of the conveyor, several pipes (usually 6) are automatically bundled with plastic tape.

4. Bundles now are carried to shipping and storage areas.

Japan makes its bid for world

More than 70% of this year's Tokyo International Trade Fair was devoted to machine tools—proof that Japan is moving into the international big time both as a manufacturer and consumer of metalworking production equipment. Some 52 Japanese manufacturers displayed 270 machine tools at the Fair, along with 154 machines exhibited by 31 foreign manufacturers representing 24 countries. (Last year's Osaka Fair had 162 machines exhibited by 41 Japanese, and 136 items shown by 26 makers from 10 countries.)

Russians absent—by request

This year the Communist Bloc was represented only by Czechoslovakia —because new Fair regulations ruled out Russian exhibits as of "propaganda value only, and of no trade significance."

That certainly couldn't be said of this year's Japanese machines at the 1959 Tokyo Fair. On the contrary, the Japanese machines for the first time appear to merit world recognition and to be competitive with machines of the most industrially advanced nations.

Trends noted at Tokyo:

- Most lathes, milling machines and jig-borers were tape-controlled.
- Entirely new types of made-in-Japan machines made their debut at Tokyo. Examples: bevel gear grinders, electrical discharge grinders.
- Japan is producing many new, simple types of machine tools for use in small shops, and for export to Southeast Asia and other industrially backward nations.

Inter-industry competition

These trends in Japanese machine tools are the natural consequence of higher demand for such machines and keener competition within the industry itself, which has been in a slump in recent years. But now Japanese government financial agencies and economists are worried for fear that the country is on an investment binge—a capital goods spending spree that may bring a new foreign exchange crisis before the year ends.

Jump in domestic demand

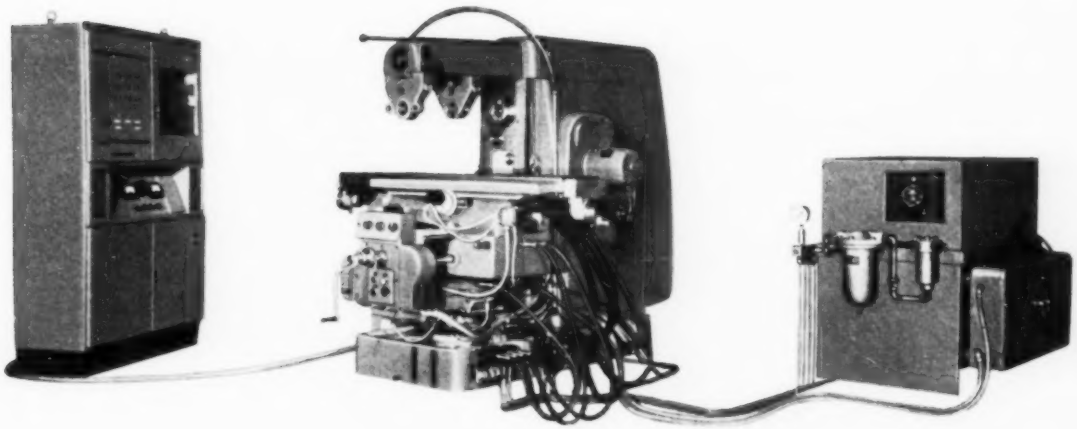
Since last September, Japan's machine tool industry has been getting orders for such large machine tools as horizontal borers, vertical lathes and radial drilling machines. This has been followed by a renewed demand for medium and small shops for multi-purpose units.

Major reasons for Japan's marked increase in demand for machine tools are said to be:

- Machine tools made during the 1956-57 boom were mostly for plant expansion, while more recent demand stems from need for replacement of obsolete equipment. This can be taken as an indication that Japanese industry as a whole has now buckled down to the long-needed job of modernizing its equipment.
- Small industries (such as parts manufacturers and body builders) that operate as subcontractors of major manufacturers have come to feel it's impossible to meet competition with outmoded machines.
- A considerable rise has been noted in the number of inquiries for machine tools. For instance, Hitachi Machinery Co has received 20% more inquiries from Asian countries this year than it received just six months ago. For another, Okuma Machinery Works has been receiving twice as many inquiries for its LS-type lathe and radial drilling machines than it did last October.
- Most demand for Japanese machine tools seems to be domestic (Exports ran to only $2 million in '58).

And while demand for machine tools increases steadily, sales competition among Japan's machine tool

Tape controls and new (for the Japanese) concepts characterized Japan's machine tools at this year's Tokyo Trade Fair . . .



3-axis numerically controlled horizontal milling machine . . .
. . . manufactured by Hitachi Precision Machinery Mfg Co in cooperation with Fuji Communications Instrument Co, consists of a magnetic tape reader, an operating console (left), pulse generator, measuring equipment, servo controller and power source. Cutting speed is 12 mm per sec; return speed is 100 mm per sec

machine tool markets

builders is keeping pace—particularly in the selling of horizontal boring machines and roll grinding machines (for big shops), and lathes and milling machines (for medium and small shops).

Some problems, too

But this same keen competition among machine tool builders has created some problems, too. The industry so far has managed to meet the increase in orders by expanding its plant, but now the time has come when Japan's machine tool builders must practice what they preach and replace their current equipment with more productive and more precise machines.

Specialized output

Japan's Ministry of International Trade & Industry (MITI) is today emphasizing the establishment of specialized machine tool production lines in order to meet increasing demand from domestic small shops, and to promote exports. A plan is being studied whereby a few particular makers will be assigned to mass production of simple machines for the small shop.

But such projects may meet with a hitch, inasmuch as most Japanese machine tool manufacturers are going all out to develop newer models on their own as a means of meeting fast-increasing competition. Thus MITI's specialization plan stands little likelihood of industry acceptance in the near future.

To show how far MITI is going to encourage a buildup of Japan's machine tool industry, the government laboratory has built "Jidic," a $170,000 numerically controlled jig borer. Later on, this machine will be manufactured in quantity by a company yet to be designated. MITI, incidentally, last year subsidized Shibaura Koki $16,000 to manufacture a tape-controlled automatic lathe.

Meanwhile back at the Fair—U S exhibitors, who have been meeting tough competition from European manufacturers (especially West Germany) did very well, selling most of the machines they brought over for

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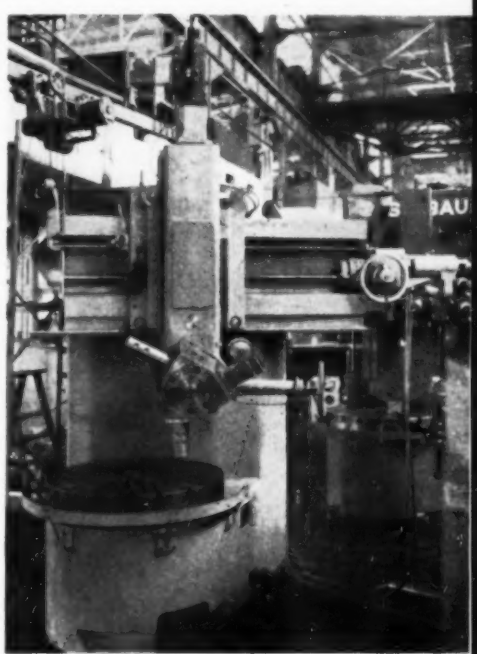


Numerically controlled vertical turret lathe . . .
. . . made by Shibaura Koki Ltd in cooperation with Tokyo Shibaura Electric Co was developed under a grant of $16,000 from the government, is designed to process a large variety of parts in small quantities

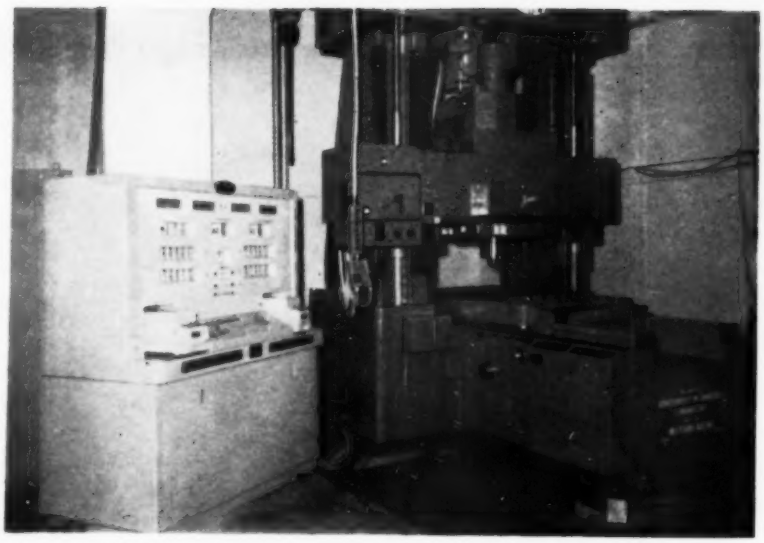
exhibit in the first three days of the Fair, the rest before Fair's end.

European exhibitors, even though they outnumbered the Americans by more than two to one, failed to sell as many machines because they brought them in on consignment.

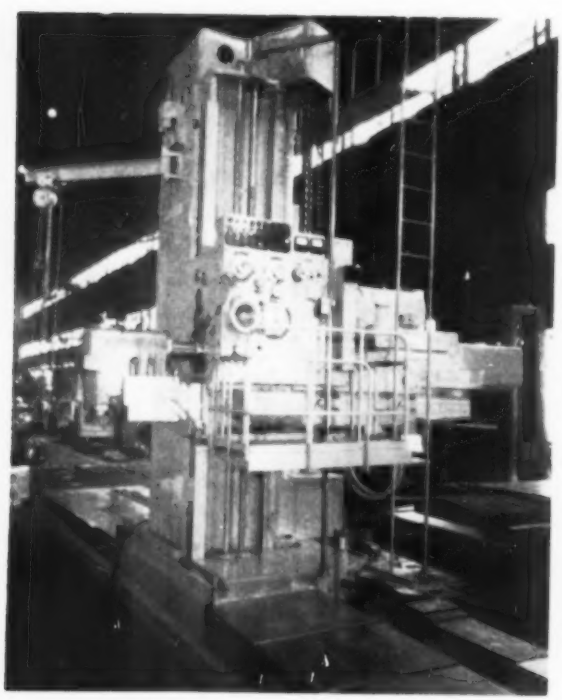
US comments on Tokyo

Several U S machine tool builders are affiliated with Japanese trading firms (Toyo Menka (Amertool), Ataka Trading, Mitsubishi Trading, Marubeni-Iida). One American representative of a U S machine tool builder said, "Unless we do something about developing the Japanese market, we may lose the best market in the Far East and consequently the rest of the Asian market."

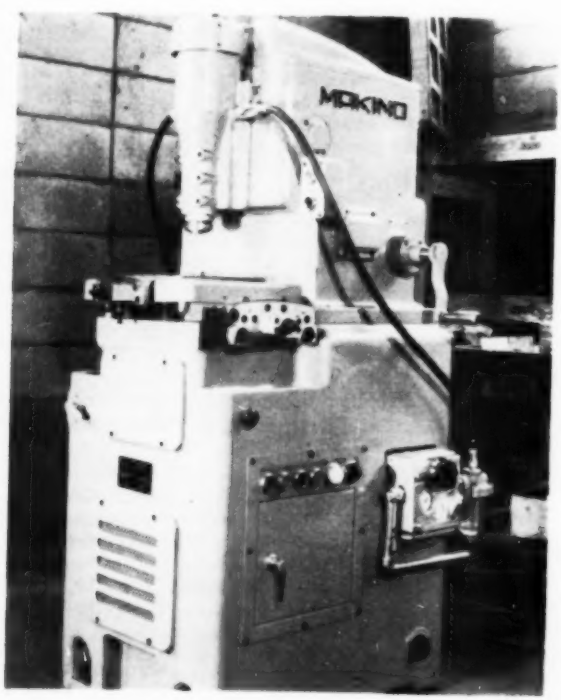
Said another American at Tokyo, "The Japanese appreciate our quality but not our price." And another added, "We are going back to the United States as soon as the Fair is over, and we're going to start preparing for the next Japanese fair at Osaka—which I understand is going to be twice as big as this one."



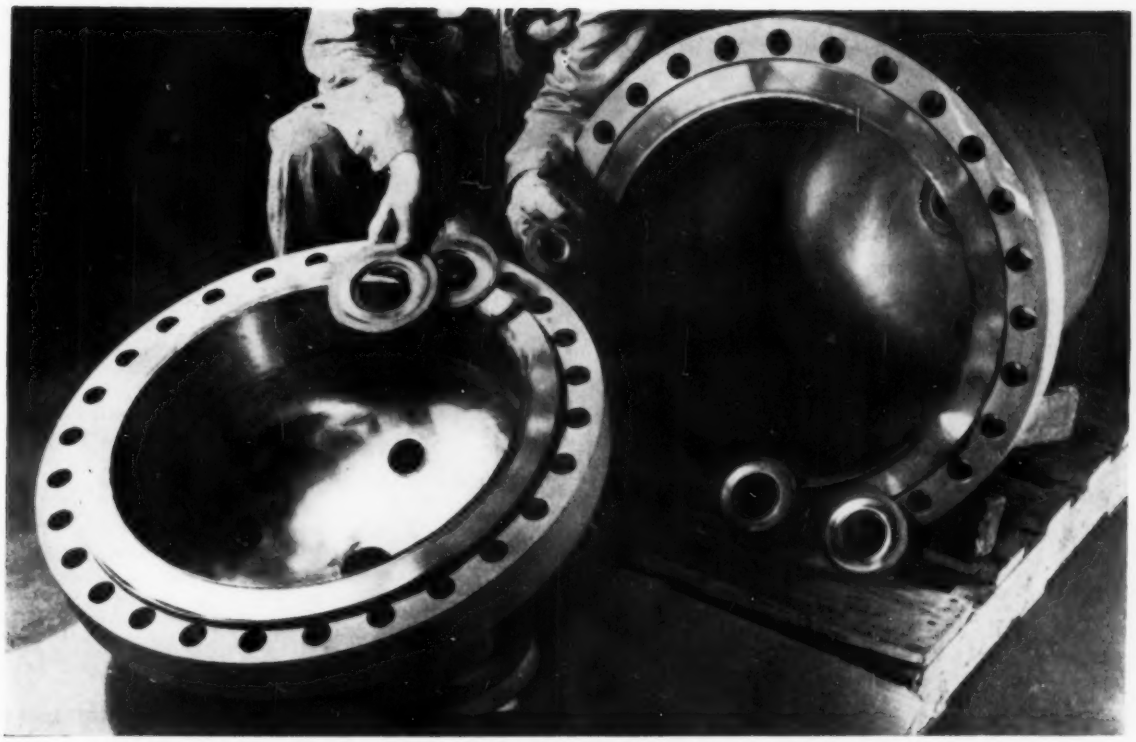
This is "Jidic" . . .
a numerically controlled jig borer developed by the Japanese Government Mechanical Laboratory and which will ultimately be turned over to a private machine tool building firm for production. Adaptable either to numerical control or manual operations, Jidic features automatic reading of coordinate values, automatic positioning and feedback. Work surface of table is 1000 x 760 mm, maximum table travel is 1100 mm, boring spindle speed ranges from 40 to 2000 rpm. Machine has 18 spindle speeds (plus 4 special speeds for centering) and 8 spindle feeds



Horizonal miller and borer . . .
manufactured by Ikegai Iron Works can also be used for angular milling and shaping by attaching an under-arm. Machine's 8-in.-diameter main shaft can change its speed as many as 24 ways, within a range of 2.5 to 500 rpm.



3-D vertical miller . . .
. . . manufactured by Makino Vertical Milling Machine Co Ltd is designed for automatic machining of precision work of complex shape, has spindle speeds up to 12,000 rpm, longitudinal table traverse of 50 cm, cross-feed of 50 cm.



Largest tantalum-lined pressure vessel gives an idea of tantalum's potential in corrosive environments

Tantalum breaks through, with new production and fabrication techniques

By Burton Payne, manager, Metallurgical Dept,
The Pfaudler Co, a division of Pfaudler Permutit Inc, Rochester, NY

Tantalum is now on the march and will soon occupy a more important place in the lineup of corrosion-resistant materials. New methods for producing the metal can now supply larger ingots and therefore larger sheets. And, recent developments in welding technique have solved some of the major problems in fabrication.

As a concrete example of this progress, The Haynes Stellite Co division of Union Carbide Corp and The Pfaudler Co have obtained the first commercial tantalum sheets of suitable size and produced a tantalum-lined, 30-gallon pressure vessel—a much larger unit than would have been possible six months ago. And even larger vessels are already being designed and built.

The major virtue of tantalum is, of course, its corrosion resistance. It is completely inert to a wide variety of materials and is therefore particularly suitable for service in corrosive environments. It is not recommended for use in strong alkalies, but is practically immune to acids, the only exceptions being hydrofluoric acid and hot concentrated sulfuric acid. In fact, its corrosion resistance is similar to that of glass.

It is also resistant to most of the liquid metals. Thus it has a large potential in nuclear-energy systems.

In addition, tantalum has highly desirable physical and mechanical properties. Its strength and ductility indicate good formability, and it is not subject to thermal shock damage. Thermal conductivity compares with that of mild steel, but this is only part of the story.

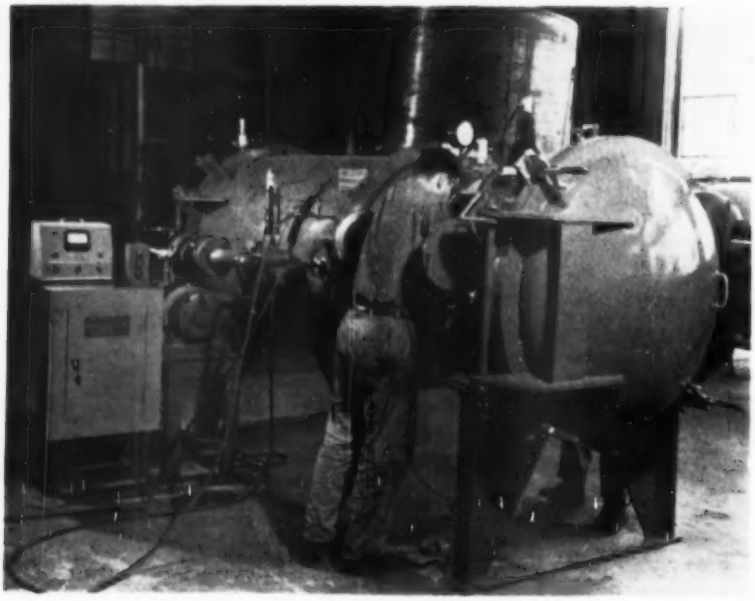
Because the metal does not corrode, very thin wall sections can be used. With a thin wall and no film of corrosion products on its surface, resistance to heat flow is negligible.

However, in contrast with its chemical inertness in the solid state, tantalum is highly reactive when molten. Therefore, in welding, the most serious difficulty is its tendency to react with gases present in the air, causing embrittlement. It will also alloy with many metals, so contact between hot tantalum and other metals must be avoided during welding. Otherwise final ductility will be extremely low.

Another welding problem is caused by tantalum's high melting point combined with the thin sections employed. Thicknesses of 0.010 to 0.040 in. are common. Thus, the comparatively high welding currents necessary to melt the material are capable of burning through the weld joint if the proper methods of joint preparation and fitup are not followed. Welds in the thin material must also be quick chilled to avoid distortion or bending.

At present, there are three conventional methods of welding tantalum: (1) resistance welding, (2) arc welding under carbon tetrachloride, and (3) Tig welding (tungsten-arc, inert-

Typical flow-purge welding chamber . . .
is used here for welding tubes to tube sheet but is suitable for many applications, can even be built around the part for field repairs



Operators weld inside vacuum-purge chamber . . .
with their heands encased in rubber gloves. Inert-gas atmosphere is best attainable

gas). **A new method, electron-beam welding under a vacuum, may eventually be used in certain applications.**

Electron-beam welding has been developed fairly recently (*AM*—Feb 23 '59, p95). The workpiece is positioned in a welding chamber where a vacuum of less than 0.1 micron is drawn. An electron-beam gun replaces the Tig torch, and the resulting weld is the finest possible with respect to weld purity and lack of contamination.

All apparatus must be mechanized, however, and adjustments in the workpiece are difficult after the chamber has been pumped down. In addition, initial equipment investment is high, and this extra expense for the sake of super-purity cannot often be justified except for atomic-energy and missile work.

In resistance welding, thin sections may be welded in air or inert gas, but thicker sections must be welded under water. Because of its low temperatures and short time intervals, resistance welding prevents a reaction with contaminating gases, and it quick-chills the weld.

The resulting weld, however, is not as satisfactory as an arc-welded square-groove butt joint from a strength and design standpoint. In addition, the lap required for resistance welding wastes tantalum.

Carbon-arc welding in a bath of carbon tetrachloride protects the weld from air and provides a quick chill, but it also permits carbon pick-up and consequently lowered ductility and corrosion resistance. This method has been largely replaced by Tig welding.

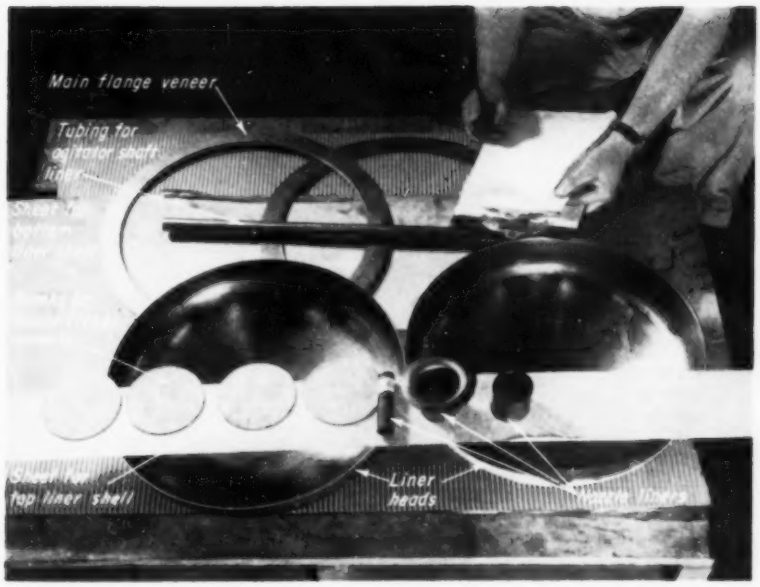
Tig welding works best

Tig welding is the most versatile method for welding tantalum. It has no inherent disadvantages other than the fact that it is more difficult to learn and apply and takes more preparation to provide good protection and quick chilling.

It is adaptable to either mechanized or free-hand welding, and pure tantalum filler wire can be easily used if necessary.

Tig welding is very suitable for mechanization, but only after careful preparations for gas protection. These usually consist of a trailing shield which follows the torch and protects the weldment until it cools off to a safe temperature.

Shielding can also be provided by a welding chamber of either the flow-purge or vacuum-purge type. In a flow-purge system, after the work is positioned, inert gas is flushed



These parts make tantalum liner . . .
for 30-gallon pressure vessel. Consumable-electrode arc melting, newly applied to tantalum production, makes parts this size possible

Physical and Mechanical Properties of Tantalum (recrystallize annealed)

Melting point (°F)	5425
Density (lb/in.³)	0.600
Vickers hardness	125-180
Yield strength (psi)	25-40,000
Tensile strength (psi)	50-75,000
Elongation (%)	30-50
Modulus of elasticity (psi)	27×10^6
Thermal conductivity* (BTU/in.²/in./°F/sec)	0.068
Thermal expansion* (in./in./°F)	3.6×10^{-6}

* room temperature values

"Fabrication of Refractory Metals," by W L Bruckart, presented to American Society of Tool Engineers, Los Angeles, Calif, Oct 3, 1959.

through the chamber to force the air out. Or, a collapsible chamber may be alternately filled with inert gas and collapsed to establish the correct atmosphere.

After the purging is complete, an operator reaches through rubber gloves attached to the sides of the chamber to make the welds with equipment already located inside.

In the vacuum-purge system, the chamber is evacuated to a predetermined level and then back-filled with inert gas. This gives the finest inert-gas atmosphere attainable for welding tantalum or other refractory or reactive metals.

The welding itself is performed according to standard procedures, with the exception, of course, of the rubber gloves extending through the sides of the chamber. Mechanized equipment can also be employed. At Pfaudler we are designing automatic equipment for our vacuum-purge chamber to assure maximum welding efficiency.

Larger tantalum sheets

These developments in welding technology have been paralleled by advances in the production of tantalum sheet. Until recently, the material was made by the sintered-powder method, and ingot weight was limited to less than 30 lb. Now however, since the introduction of consumable-arc vacuum melting, ingots up to 110 lbs have been produced. In addition, the vacuum-melted material permits porosity-free welds.

The first major product employing all these technical advances is the 30-gallon, tantalum-lined pressure vessel produced by the cooperative efforts of Pfaudler and Haynes Stellite. The outer vessel is designed for 500 psi at 650 F in accordance with the 1956 ASME Boiler Code Section. Tantalum, 0.030-in.-thick, is used only as a corrosion-resistant liner. Both the backing material and the accessory items are made of Type 430 stainless steel.

The vessel was actually built as two separate units: the stainless-steel outer vessel, nozzles, and flanges, and the tantalum liners for the vessel and accessories. Further, we can consider the tantalum liner assemblies for top and bottom separately, as they involved different problems.

Each of them consisted of a liner shell, a liner head, one or more nozzle liners, and a flange veneer to cover the outer flange of each nozzle, plus a veneer for the main flange. The main difference was in the number of nozzles and their location.

Starting with the bottom head, it was spun to conform with the stainless-steel head, with a generous radius to assure good drainage. Then it was checked in the stainless-steel vessel, and adjustments were made to assure a tight fit.

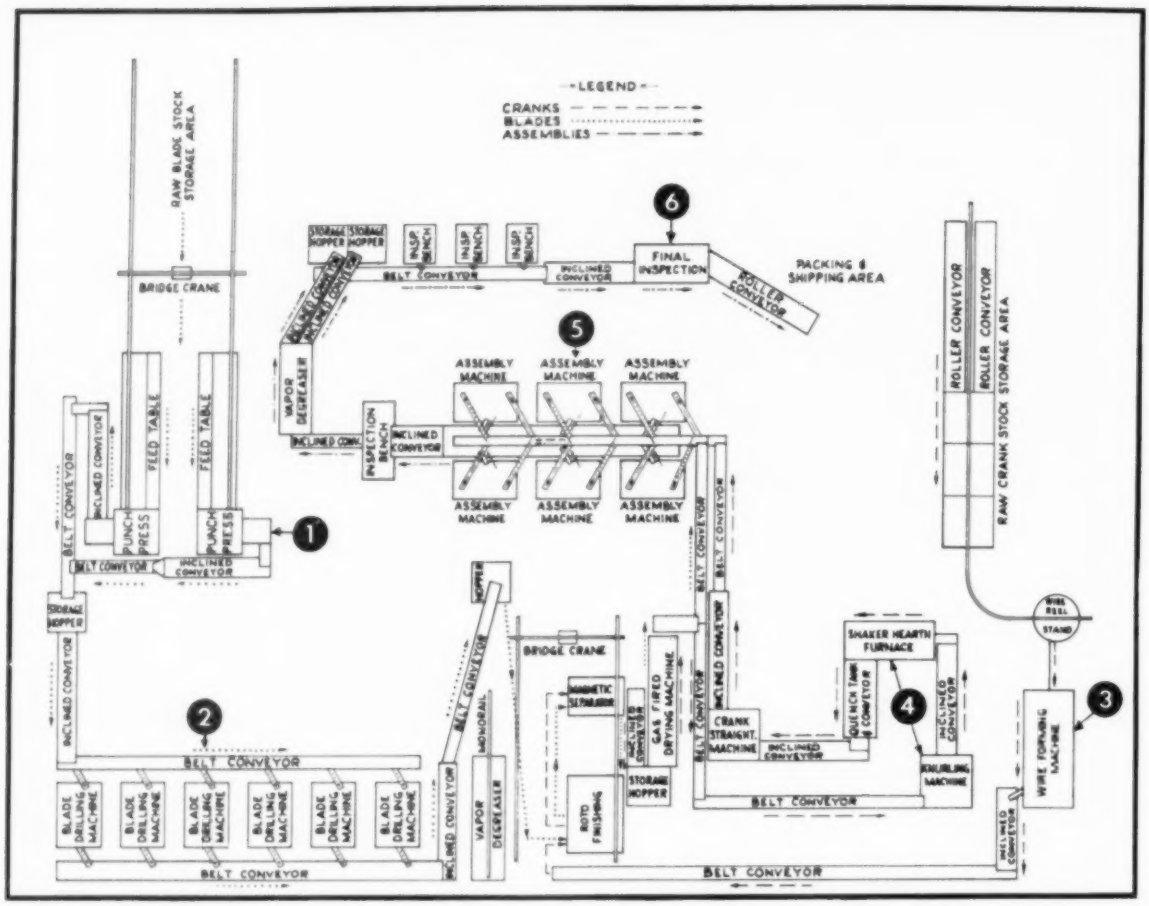
After that, it was welded to the liner shell inside the vacuum-purge welding chamber. As the bottom had only one nozzle and that one was located on the axis of the vessel, the nozzle liner could also be welded on at this time. After the bottom liner assembly was inserted in the vessel, the nozzle flange veneer was welded to the nozzle liner.

Fabrication techniques for the top liner assembly were generally the same except for the nozzle liners. Only the center nozzle was on the axis of the vessel; all the others were normal to the head. Therefore, it would have been impossible to insert the liner in the stainless-steel vessel if they were welded on the liner first.

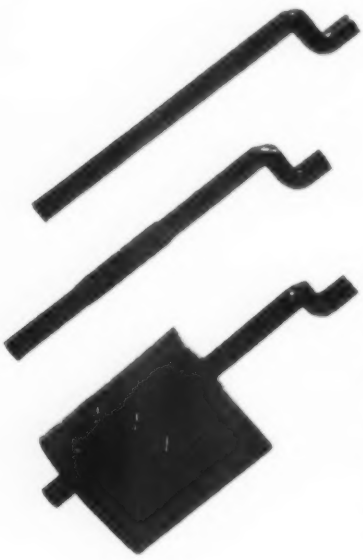
After the tantalum head and shell were welded together, they were positioned in the outer vessel. Next, the nozzle liners were inserted into the nozzles and welded to the liner head from the inside. Then a tantalum flange veneer was welded to each of the nozzle liners.

The final operations for both top and bottom consisted of adjusting the tantalum liner assembly and welding on the main flange veneer.

The fabrication of this tantalum-lined reactor marks the entrance of tantalum into another important application in the chemical industry. In a short time, all of the fabricated articles now available to the process industries in other materials will be available in tantalum.



Conveyorized lines . . . for blades (left) and cranks (right) feed toward each other, so that both parts can pass through the same barrel-finishing, magnetic-separator, and drying units. Parallel overhead belt conveyors take the parts separately to hoppers at assembly machines. Storage hoppers along the parts production and assembly lines insure that production continues when machines are down for tool changes or adjustments. (See other photos for closeups of operations numbered on above diagram.)



To make automotive-turbine blades...

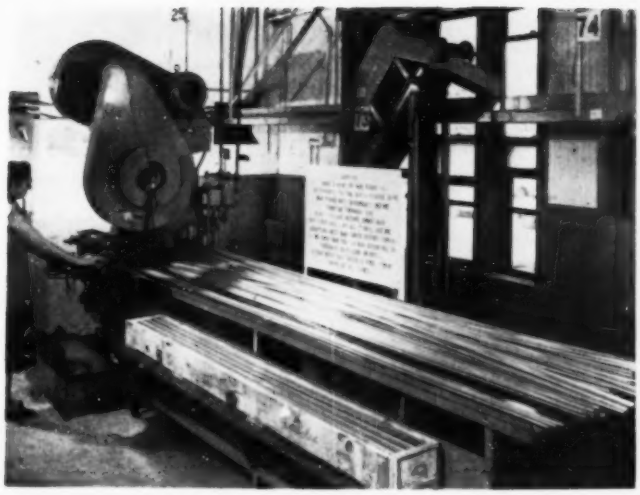
Meshed lines feed

By **Frank A Cuthbertson,** master mechanic, Milwaukee Operations, AC Spark Plug Div, General Motors Corp

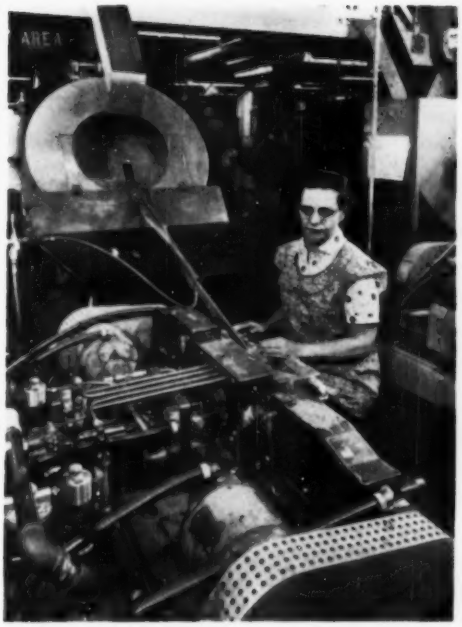
An elaborate, fully conveyorized setup now turns out production quantities of stator-blade assemblies for Buick's new twin- and triple-turbine Dynaflow transmissions. The setup, located in the A C Spark Plug plant of General Motors in Milwaukee, assembles inch-long blades on knurled steel cranks.

Layout is ingenious: The airfoil-shaped stator blades are formed and machined in one area, the cranks in another. Conveyors feed the blades and cranks to an in-between area, so that both parts can pass through common finishing, magnetic-separation, and drying units before they are assembled. And to make the operation even more automatic, the company has installed a number of special hopper-fed automatic drilling and assembly machines.

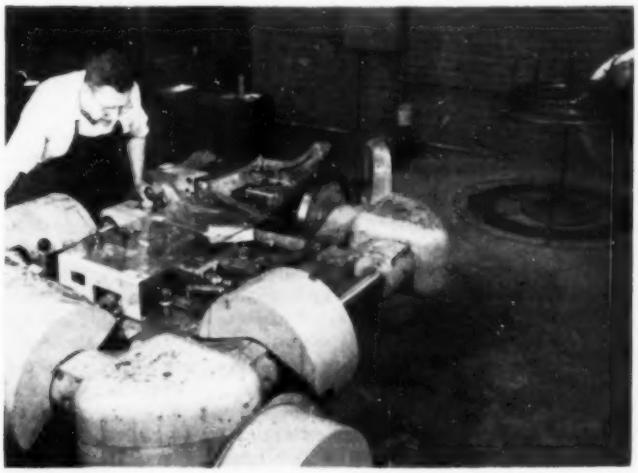
This layout enables A C Spark Plug to produce large quantities of close-tolerance assemblies. Each blade assembly consists of a section



1— Fully guarded die . . .
in No. 19 Bliss OBI press cuts blade blanks from aluminum-alloy bars, coins them to shape, then broaches them to length



2— Automatic drilling machine . . .
designed by plant engineers, is an opposed-spindle unit that drills hole through stator blades. To minimize downtime and reduce operator fatigue, hopper feeds and automatic work positioning and clamping devices are being added to these machines



3— Crank-forming machine . . .
is a Baird automatic four-slide unit that can produce 6600 pieces per hr. To increase tool life, cutoff and crank-forming tools have cemented-carbide tips; other tools are made of hardened HSS

assembly machines

of extruded aluminum bar (63S-T5) that fits over a 2.180-in.-long, 0.154-in.-dia steel crank (SAE 1018).

Making the parts

The reproduced sketch of the layout traces each step in the manufacture of the blades and cranks, as well as the assembly and gaging operations.

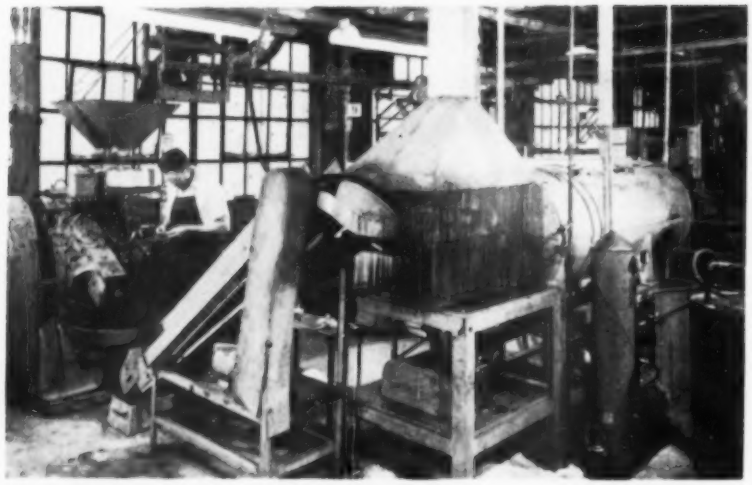
Here's how the setup produces stator blades: Extruded mill-length stock is fed into punchpresses, which cut the blade blanks, coin them to the required shape, and broach them to finish length—0.942 in. wide and slightly more than 1 in. long. Accuracy is important: Blades must be held to within 0.002 in. of specified size at each of 65 gaging positions.

Next the blades are chuted to an elevator conveyor that delivers them to nearby blade-drilling units. These special machines, designed by the plant's engineers, drill a 0.1562-in. hole through each blade, into which the crank will later be inserted. The cycle in these opposed-spindle machines is automatic.

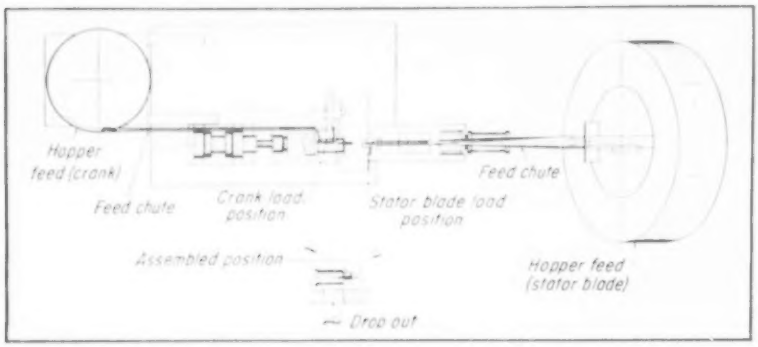
Final step in blade manufacture is to convey the blades through finishing, magnetic-separator, and drying units. Overhead belt conveyors then take the blades to hoppers at each assembly machine.

Meanwhile, cranks for the blades are being made in another area. Cold-drawn wire, fed into an automatic four-slide machine, is cut to length and formed to shape. After barrel tumbling and cleaning, the cranks go by belt conveyor to a knurling machine, where dies produce 13 serrations (⅝ in. long) on the crankshaft.

Now the cranks move by elevator directly to a furnace for heat treatment. Cranks, which must withstand 80 in.-lb of torque without loosening



4— Knurling machine . . .
(left) is a Waterbury-Farrel unit that produces 13 serrations on shaft of the crank. Elevator conveyor moves knurled shafts directly to shaker hearth of Hevi-Duty furnace (right) for carbonitriding. Shafts later are straightened in another Waterbury-Farrel machine before assembly with blades



5— Assembly machines . . .
six of them fit together the blades and the cranks. Angle of 35° between crank arm and blade is held within ±30 min of arc. Bowl-type vibratory hoppers feed blade blanks and cranks to opposite heads of this automatic machine

in the blades, are carbonitrided at 1515 F for 20 min; this gives them a hardened case (0.003 to 0.007 in. thick) that provides resistance to wear. Finally, the cranks go through a straightening machine, then are conveyed to hoppers at the assembly machines.

In the assembly operation, vibratory hoppers feed blade blanks and cranks to opposite heads of automatic assembly machines, specially designed by A C Spark Plug engineers. These machines position the parts in correct angular relation, then push them together to a specified bearing length to complete the assembly.

Inspecting the parts

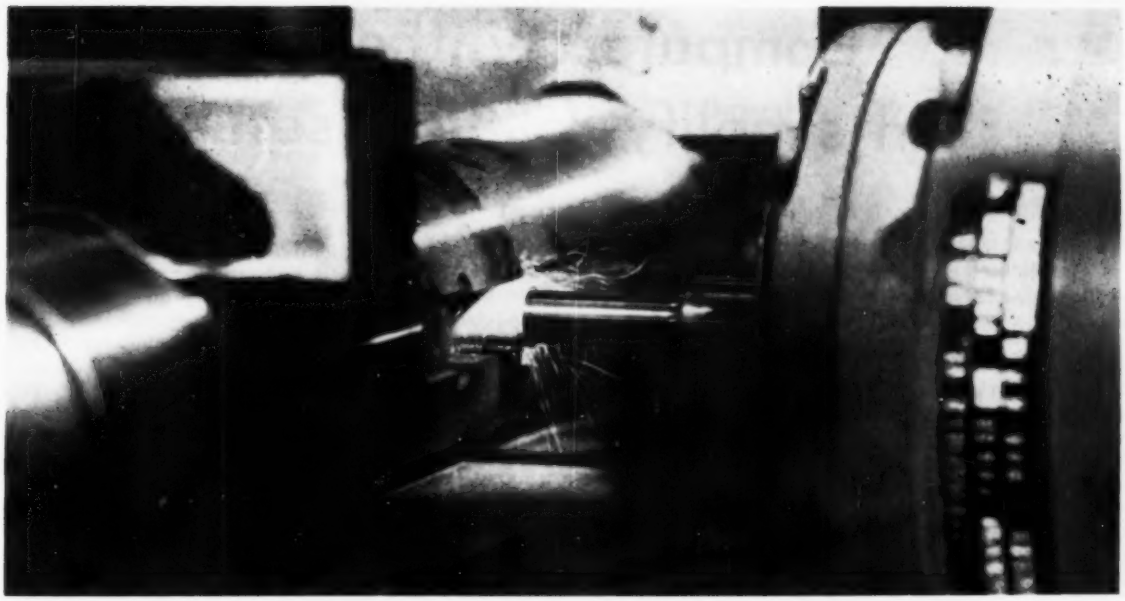
To insure high quality, an inspector checks—at least once every half hour—the parts made at each machine. He posts results on control charts at each machine and takes prompt action when a chart indicates that a machine is approaching an out-of-control condition.

Inspection doesn't end here. Completed assemblies move to an inspection bench on a conveyor that keeps the product of each assembly machine separated. In each of three gages, 20 assemblies from each lot of 200 by each machine are checked. When there is a discrepancy in these 20 assemblies, the entire lot of 200 assemblies is routed to a separate bench for 100% gaging, and engineers take immediate steps to adjust the assembly machine responsible for the out-of-tolerance work.

Assemblies approved by the final inspector move through a conveyorized vapor degreaser and onto a bench-high belt conveyor, where two inspectors check them visually for nicks or burrs that might impair blade functioning in the transmission assemblies. Midway along the conveyor, after the assemblies have been checked by the first inspector, they are automatically turned over so that the second inspector can check the other sides.

Finally, the product inspector scale-counts, packages, seals, labels, and prepares the assemblies for shipment. A control chart accompanies each shipment as evidence of the quality level maintained.

6— Three gaging fixtures . . .
at the final inspection bench give a percentage check of completed adjustable stator blades. Assemblies from different machines are kept separate until each lot of 200 is accepted, so that discrepancies can be corrected promptly



Internal-grinder quill finishes precision slots in opposing sides of a machine spindle

Surface grinding at 60,000 rpm solves slot problem

Tool engineers at Bryant Chucking Grinder Company, Springfield, Vt, were faced with a tough grinding job. Two narrow slots, which opened into a hollow bore, had to be finish ground in a machine spindle. These two ground slots, diametrically opposite in the shaft, were 1-9/16 in. long by 0.500 in. wide with a +0.0005 in., -0.0000 in. tolerance on width. The slots also had to be held central, or in line, with one another to very close limits.

It was apparent that a standard "high-speed" belt-driven attachment for a surface-grinder spindle would be inadequate. The speed of these attachments is limited to approximately 20,000 rpm, which will operate a grinding wheel under ½ in. at less than 2500 sfpm. Also, the side load on the front bearing of the attachment, caused by a belt without an idler, was likely to cause extreme difficulty in maintaining the required precision.

However, the problem of grinding comparatively small slots appeared to be no more difficult than that of precision grinding small bores. A standard 60,000 rpm high-frequency internal grinding spindle seemed to be an ideal solution, with high-frequency power readily available.

At 60,000 rpm, a 7/16-in.-dia wheel rotates at well over 6,000 sfpm to provide efficient grinding conditions. In the integral-motor spindle, there is no side load, other than grinding load, on the bearings—which are axially preloaded. A unique ball slide, surrounding the cage in which the spring-loaded bearing is mounted, takes out any radial looseness yet assures positive axial preload.

Results with the setup shown were well within the print specifications for the part. The 0.0005-in. width tolerance was held with no difficulty and centrality of both slots was maintained within ±0.0001 in. A 20-mu-in. finish was obtained with ease; in fact, in the opinion of the foreman on the job, this could have been improved substantially had it been necessary.

A 38A60NVBEM wheel, mounted with a No. 10-32 threaded shank, was used. This enabled the mounted wheel to be screwed directly into a standard removable quill which, in turn, was mounted in the high-frequency spindle shaft. Workpiece was a steel forging, carburized and hardened to Rc 55-60. A bracket on the surface grinder placed the high-frequency spindle in the same location as a conventional surface-grinding spindle. Work was placed with sides of the slot horizontal to utilize normal feed of the surface grinder. Normal table traverse produced flat slot sides, and slight table-feed oscillation blended grinding lines to maintain finish.

At the Bryant plant, where high-frequency power is available, this arrangement provided a particularly economical and effective solution to a tough machining problem. It should be pointed out, however, that in recent times, compact, inexpensive high-frequency generators have become increasingly available for plants not so equipped. Spindle speeds of 100,000 rpm, and even 150,000 rpm, now can be used on internal grinding machines, and for other high-speed machining operations too. Usually, oil-mist lubrication must be applied to the bearings in spindles operating at such extremely high speeds. This problem, too, is simplified by the use of an oil-mist lubrication kit. Mist lubrication also protects the high-speed spindle during air line failure.

In plants where internal grinders are used on the production-line, high-speed spindles for other machining applications are doubly economical. Generally, spare spindles are kept on hand for use with the internal grinders. These spares can "double in brass" to solve other grinding or high-speed machining problems where a high peripheral cutting speed must be maintained on a small-diameter cutting tool or wheel.

Computer synthesis can simplify roll-flow setup

Synthesis of machine tools by computers offers another major manufacturing-engineering tool for tomorrow. Machine-tool simulators may check metalworking processes, before actual operations begin, just as flight simulators now test new aircraft systems and pilots. Critical problems of tooling and setup found in roll-flowing methods show what can be done.

By Henry M Lakin, senior scientist
Missile Systems Division Lockheed Aircraft Corp, Van Nuys, Calif

Time-consuming tool, and method, development is holding back full use of roll flowing. Potential users say they cannot afford the long lead time on short runs of pieces needed "tomorrow." Although some cut-and-try still will be required, lead time might be shortened by, in effect, converting a computer to a synthetic roll-flowing machine, then calculating the sizes, shapes, speeds, mandrel configurations, rolling pressures, etc, to produce the desired shape.

Efficient use of roll-flowing processes, also called roll forming and shear spinning, such as Hydrospinning and Floturning, is limited by a single bottleneck. Cut-and-try techniques for developing engineered parts are both necessary and costly before a single acceptable part can be turned out.

Once a procedure has been established, it is not difficult to produce quantities of duplicate close-tolerance parts. However, techniques learned in developing one part cannot necessarily be applied to another part. Each new part must have a preform or blank developed—and the speeds, feeds, and pressures must be determined through empirical methods. As this approach frequently creates a high ratio of tooling cost to finished-part cost, it is fundamentally undesirable from an emonomic point of view. Meanwhile, the process offers some desirable engineering advantages in its products.

Synthesis, or simulation, of the roll-flowing process by high-speed computers seeks to minimize this development time. Furthermore, it attempts to create a uniform set of rules, based upon experimental empirical, and analytical knowledge, for determining the sequencing of roll-flowing operations speedily, efficiently, and cheaply.

Systematic analysis and synthesis of roll flowing promises additional advantages, such as improved product quality and increased yield. Recent developments such as the design of electric motors show the practical trend to computer synthesis. The technique has proved itself economically sound in such technological processes as automatic control of machine tools and in automatic chemical - process control. The groundwork for synthesis of plastic deformation is established as a result of the recent upsurge of interest in the theory of plasticity. Numerous results of practical importance to designers are well within reach and practical control of plastic deformation is essential to future metalworking progress.

Analysis and synthesis of a manufacturing process such as roll deformation starts with an analytical description of the process in mathematical form. A set of formulas is developed to relate the operating variables of the machine tool, the material (blank), and the manufacturing process to the desired product characteristics. From this analysis a mathematical (prediction) model can be constructed as an internally stored computer program.

Computer output is a set of operating instructions for the proper sequence of roll-flowing operations necessary to roll a prescribed blank to a finished part having the required product characteristics. These instructions may be physical representations such as cams or templets or numerical commands on tape or cards directly usable as input to a numerically controlled roll-flowing machine.

Plastic Flow Theory Today

A workable mathematical theory of plastic flow has been attempted via several approaches. All of these procedures, of necessity, idealize the complex mechanical behavior of structural materials to a certain extent. And, specific approaches establish their own ideal conditions which differ according to the different fields of application for which they are derived.

While Hooke's Law adequately expresses the main characteristics of an elastic material, no similarly simple description of the mechanical behavior of plastic materials is possible. A mathematical theory attempting to take account of all mechanical phenomena observed in the plastic range is not presently practical.

However, several workable mathematical theories built around the notion of "perfectly" plastic materials, which provide the foundation for a mathematical description of the roll-flowing process, do exist. Among these are the theory of Saint Venant-Levy-Misis which neglects elastic strains, and the theory of Prandtl-Reuss which considers both plastic and elastic strains.

Where restrained plastic deformation is considered, the Prandtl-Reuss theory is found to be more accurate. It is used, for example, to determine safety factors in structural loads. Elastic strains are neglected in the theory of perfectly plastic materials which consider only unrestricted plastic deformation.

Theories such as these are well developed. If there were no further complications, a combination of these theories could yield, quite easily, the mathematical models needed for computer synthesis of roll flowing. Unfortunately, metallurgy isn't that simple. The effect of strain-hardening, which is macroscopic, and the various grain-structure anomalies, which have a microscopic effect, run counter to these theories in practice.

Contrary to popular belief, materials do not react in the same way to all types of loading; they are not isotropic. It would be fine if they did have this property, because then a simple extension of the perfectly plastic flow theory by the introduction of isotropic strain hardening would provide the model necessary for computer synthesis.

This lack of isotropic response to loading helps to explain the success

for some substances and the lack of success for other materials of Von Karman's mathematical analysis for the velocity of propagation of a plastic shock wave. This velocity is determined by a plastic modulus which is given within experimental error by the statically measured strain-hardening curve.

Knowledge developed in this area will be valuable to far more than just roll-flowing operations. Better techniques in predetermining the effects of plastic flow and strain-hardening would markedly improve processes such as extrusion, forging, swaging, deep drawing, and rolling.

An immediate and potentially fruitful major effort in this connection would be to seek a set of additional parameters which can be related to statically measured properties of specific materials for the development of more general flow criteria. Broadly, the specific approach is to abstract into the mathematical model suitable choices of experimental and empirical information on strain-hardening.

Also, it is known that there are situations in which a body ceases to strain-harden, namely certain combinations of high shearing strains with approximately hydrostatic pressure. For these bodies the intuitive prescription of what it is possible to impress on a body fails. All that can be done is to apply a shearing force up to the value at which the body becomes plastic. Then it is impossible to push harder on the body.

Once the body is subjected to this critical force, the only further control of the situation possible is to change the angle of attack of the shearing force (rollers) with any speed desired. Always, the same force is required to do it. It would therefore appear that in the limit, with certain types of deformation at that limit, the assumption of an ideally plastic body approximates experience.

Where an isotropic strain-hardening theory is inadequate, the next approximation is to consider the effect of non-isotropic strain-hardening. The effects here are most complicated but it is clear that a fully satisfactory model must provide room for non-isotropic strain-hardening. How far down toward the molecular it will be necessary to go is difficult to say. In any event, there is plenty of complication that may be successfully exploited no further down than the grain structure.

One problem of special interest in roll flowing is the pre-plastic effect achieved before reaching the actual flow limit under certain deformations. It is known in the literature as the Bauschinger effect. An intuitive explanation of this effect is that even though strain-hardening has begun, the material softens upon removing the load.

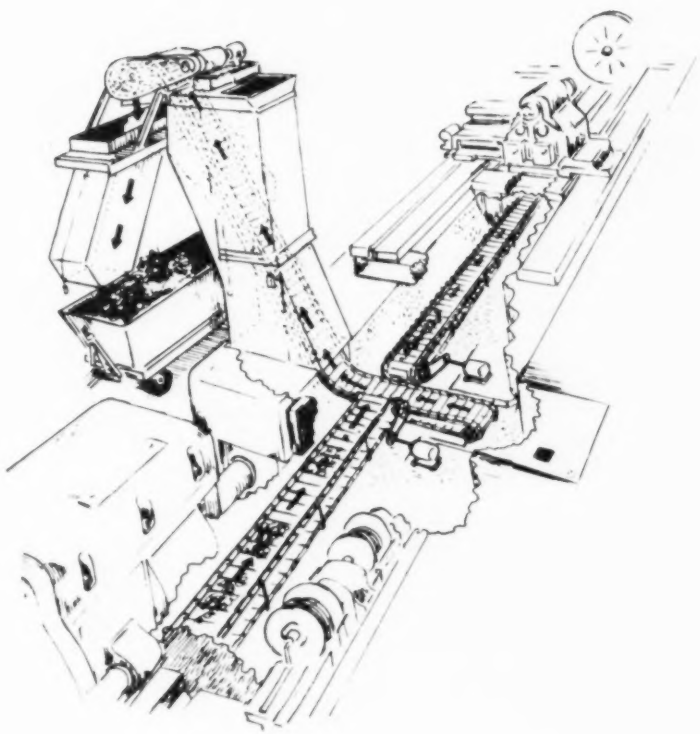
Several valuable leads are given in the literature which may in time be fruitful in this study. In particular the possibilities of mathematical singularities have not as yet been sufficiently exploited. Not only are they present in the body of material whenever there are discontinuities in the elastic constants, but they are present when there exists free faces with shearing stress on the surface at right angles in some roll-forming operations. It is possible that plastic flow may well take its initiation at some mathematical singularity. It is even possible that such singularities may provide the chief clue to the successful explanation of flow and fracture phenomena.

Automatic conveyor removes big chip loads

The machining of huge forgings calls for large-scale chip disposal. The sketch on the right shows how General Electric handles chip loads at its Large Steam Turbine-Generator plant in Schenectady, NY. Here automatic conveyors, installed under lathe beds, carry away chips that accumulate when big forgings are machined into rotors for GE turbines.

The new system, designed and supplied by the Gifford-Wood Co of Hudson, NY, incorporates hinged-pan conveyors that pass under the lathe, automatically conveying chips from the lathe beds and carrying them to elevating conveyors. From there, the chips ascend to a double chute, where they are dumped into tote boxes.

Chips were formerly collected in boxes placed beneath the lathes. When each box was full, an overhead crane had to lift off a metal grating, haul out the box, deposit it on a truck, and then drop in an empty box and replace the grating. The new system eliminates the overhead crane, reduces machine downtime, and reduces the amount of auxiliary handling equipment once needed.



These stainless-to-Zircaloy joints held till the pressure reached 13,200 to 17,200 psi

Diffusion bonding joins Zircaloy and stainless

By Dr J M Gerken, Knolls Atomic Power Laboratory, Schenectady, NY*

Diffusion bonding, the process that joins parts together by simply applying low-level heat and pressure, has solved the problem of joining Zircaloy-2 to type 304 stainless steel, at least in tubing up to ⅞-in. OD with ⅛-in. wall thickness.

Joints made with this process have withstood 200-cycle thermal tests between 100 and 600 F and 100-cycle pressure tests between 100 and 3500 psi at 500 F. Hydraulic pressures of 13,200 to 17,200 psi were required to burst well-bonded joints.

In diffusion bonding, the bond is made because the parts are held in intimate contact, and atoms and molecules from each part migrate across the interface. In effect, the parts "grow" together.

Temperatures are below the melting points of the materials involved, so there is no fusion—initially. However, as diffusion progresses, a low-melting alloy phase forms. This accelerates the bonding process and helps to bond at areas of slight misfit.

The process is not a new discovery. For a good many years it has been known that diffusion, which occurs relatively rapidly in gases and fluids, also takes place in solid metals, though at a much slower rate. It has also been known that diffusion bonding is accelerated by increasing either heat or pressure, or by increasing both of these.

However, as a joining method, diffusion bonding has not been competitive with welding, brazing, soldering, and other common techniques. Now, though, as joining problems become more complex, it is beginning to show that it can solve problems that the other methods cannot.

One of them is joining stainless steel and Zircaloy. Here, the fusion welding processes can produce a solid bond, but in doing so, they create zirconium-iron, chromium, and nickel alloys which are extremely brittle. Other methods have not produced consistently good bonds.

Method conserves Zircaloy

Our problem at Knolls was to fabricate a specimen tube and a coolant-return tube for an irradiation experiment. Zircaloy tubing, with its low neutron-absorption rate, would permit a given total amount of irradiation in much less time than stainless steel would, but we could not readily secure enough Zircaloy-2 of the required diameter and quality.

However, there was still the possibility of constructing the specimen section of ⅞-in.-OD by ⅝-in.-ID Zircaloy and bonding this to the type 304 stainless tubing used in the rest of the tube. Diffusion bonding had already joined Zircaloy and stainless steel in approximately ¼-in.-OD tubing, so we decided to try it on this larger size.

Procedure

Because of the different coefficients of expansion of Zircaloy and stainless steel, we decided on a conically tapered joint with the Zircaloy tubing fitting inside the stainless (sketch, opposite). Three-inch lengths of the Zircaloy tube were tapered on both ends to provide two joints per test specimen, and the stainless tubes were tapered to match. Taper angles of 7°, 9°, and 14 were employed.

The mating conical surfaces were held in contact by a ½-in.-dia through bolt made of type 410 stainless steel. Pressure was applied by tightening the nuts on each end.

With this arrangement, the radial differential expansion between the stainless steel outside and the Zircaloy inside tends to open the space at the joint. On the other hand, the lengthwise differential expansion between the 304 tubing and the 410 through bolt causes an axial compression on the joint. As the taper angle decreases, the axial motion required to maintain close contact between the mating cones is increased.

In most cases the bonding was performed in a horizontal tube vacuum furnace which had been evacuated to a pressure of approximately 0.03 micron of mercury. A temperature of 1868 F was held for 80 min.

Induction heating produced equally good joints with temperatures

* Knolls Atomic Power Laboratory is operated by the General Electric Company for the United States Atomic Energy Commission.

slightly higher than 1868 F and times of 2 to 3 min. For this operation, the assemblies were supported vertically inside a pyrex tube continuously flushed with dry helium.

Joints are thoroughly tested

Finished joints were all mass-spectrometer leak checked after the bonding operation and after thermal-cycling and pressure-cycling tests.

For the thermal-cycling tests, the temperature of the sample was varied between 100 and 600 F at least 200 times. These tests were performed either in a pressurized water system on a 5-min cycle or in an air cycling apparatus with an electric resistance heater and a blower for cooling, where a complete cycle took about 7 min.

Pressure-cycling tests were run at 500 F between the pressures of 100 and 3500 psi for 100 cycles per specimen. Pressure was applied and removed manually. Hydraulic bursting tests were performed at room temperature.

Longitudinal sections were cut from samples that had been thermally cycled and from other representative samples to determine what proportion of the mating surface was bonded. The bonded area was also estimated on the hydraulic bursting samples that came apart.

No failures occurred on pressure cycling between 100 and 3500 psi, and only one failure occurred on thermal cycling. This one failed after 900 cycles. Examination of longitudinal sections of the joint indicated that it was a poor bond from the start, and therefore the test was not representative.

Stainless inside or outside?

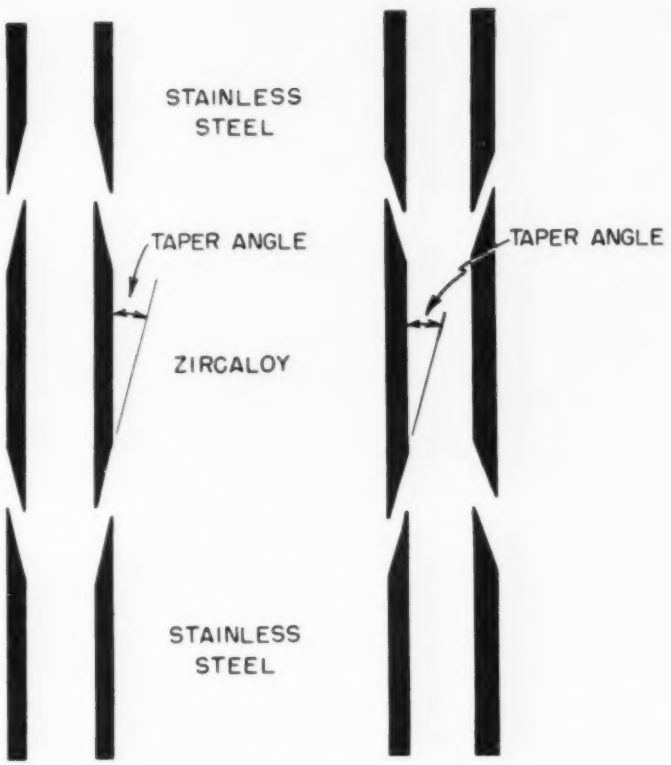
Additional joints were made with the taper angles reversed so that the stainless steel tubes fitted inside the zircaloy tubes. In theory, this is better for forming sound joints, because the differential expansion between the zircaloy, the 304 stainless, and the 410 stainless are cumulative.

Thus, at bonding temperatures, they build up the pressure on the contact surfaces instead of cancelling each other out as they do in the other arrangement. However, the assembly cannot withstand as great an internal pressure because of the lower strength of the Zircaloy.

The results are not conclusive as to whether the best condition for bonding is with the stainless steel on the inside or the outside of the taper. However, it is obvious that for withstanding internal pressures the better arrangement is with the stronger stainless steel on the outside.

In this case, the Zircaloy, which has a lower Young's modulus than stainless steel, will be compressed against the stainless steel tube, reducing the tensile stresses on the bond. Further, when the bond is first made and cooled from the diffusion temperature, it is given a compression load because of the greater contraction of the stainless steel.

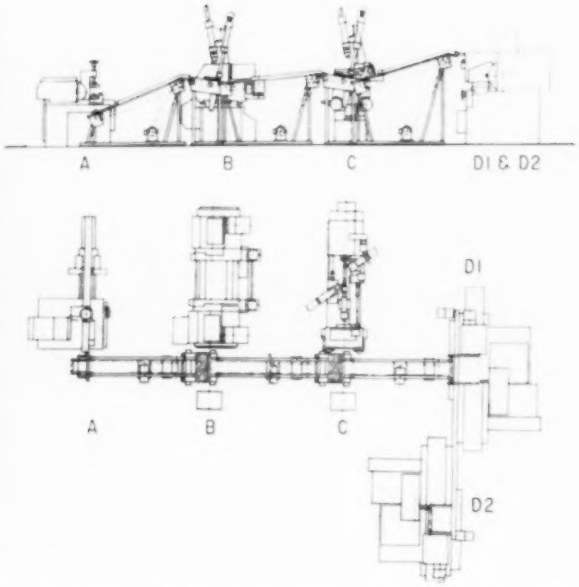
However, making the bond with the stainless on the outside poses more of a problem than the reverse condition. On heating to form the diffusion bond, the stainless expands away from the Zircaloy, leaving a void unless some means is provided to compensate for the expansion. This is possible only in butt joints having a conical overlapping joint interface. In cylindrical lap joints, the stainless must be inside.



Both types of joint were made during tests . . .
Bonds were equally good, but the joint with stainless on the outside (left) will withstand greater internal pressure

A good joint has 95 to 100% bonded area . . .
Taper here is 10° with Zircaloy (upper) on outside (10X)

Structure of bond area . . .
in 10° conical taper joint. Zircaloy (upper) is outside (100X)



East Germany's showpiece at Leipzig Fair . . .
. . . was this link line for production of electric motor armature shafts from round bar stock. The first four machines are connected by a three-section chain conveyor with storage magazines in between. Work is carried across to the final grinder (upper right) by a transverse belt conveyor. Output is 60 shafts per hour. See text for key.

East Germany automates with

East Germany has come up with a five-station link line that combines standard machines with handling and transfer equipment in a flexible layout—a low-cost form of automation. (Principle is similar to that used in GE's "Bldg 85"—*AM*—Dec 17 '56, p105)

Star exhibit at the recent Leipzig Fair, the line was tooled up there to produce electric motor armature shafts from round bar stock—consisted of a circular saw ("A" on drawing above), end-milling and turning machine ("B"), twin-slide copy lathe ("C"), and two cylindrical grinders ("D1" and "D2"). All operations are controlled by interlocks and limit switches. Cycle time is one minute.

Bar stock (30-mm) is fed into the saw by a clamping fixture moving on guideways to the bed extension. When the bar is moved in to length (273.39mm), it is clamped downward against a V-block at the work position. Then the 315-mm saw feeds in hydraulically from behind.

Saw head and clamp then retract, and cutoff section is pushed forward by the approaching bar, which travels in for the next cut. Machine stops when bar is consumed and traveling clamp needs reloading.

As each blank leaves the machine, it drops onto suspension hooks, where it is engaged and carried forward by pawls on the chain of the first section of a conveyor. This deposits the blank on inclined storage rails that supply the second machine.

The storage magazines along the line allow for tool change, minor maintenance and brief stoppages on any one of the first machines without interrupting output.

When a magazine is empty it stops the adjacent machine. When it is full, the incoming conveyor stops. This action is governed by interlock switches that control independent drives to the separate conveyors. Blanks are released singly from gravity rails of the first magazine by a spring-loaded escapement table which is depressed by extended fingers on the load arm that serves the end-milling and turning machine.

After the downstroke and return of the arm, the load arm descends to pick up the blank on the table with pairs of claws, then returns to raised position.

Transfer mechanism is shuttling head

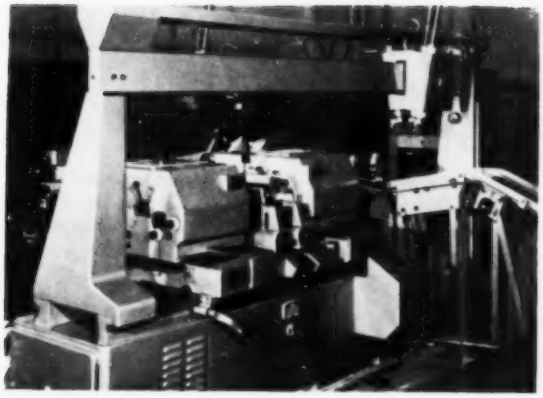
Transfer mechanism consists of a shuttling head with two angled arms, is air-operated for both vertical movement and claw operation. The shuttling head travels on an overhead rail between the conveyor and work position, is driven by roller chain.

The blank gripped by the load arm is now carried across to the machine and lowered into the open jaws of the electro-mechanical fixture. As the work is clamped, the jaws release it, and the arm retracts.

The double-ended, four-spindle machine then starts its cycle. Blank ends are first milled to length as the travelling fixture moves past the opposed cutters. The fixture stops at the second work position, where both ends are turned and center-drilled by infeeding tools.

Meanwhile, the transfer unit has fetched the next blank and has returned to the fixture to repeat the unload-load sequence. When the machine cycle has been completed, the fixture shuttles back to the start position, the turned shaft is unclamped and extracted by the load arm, and the load arm locates the new work.

Then the unit moves across to drop the outgoing shaft onto the exit conveyor. Two electric gages bridging the



Double-ended machine . . .
. . . has shuttling fixture with electro-mechanical clamping. Work is end-milled to length at the first position, semi-turned and center-drilled at the second. Overhead unit for work transport has separate inclined arms for loading and unloading. Loader extracts a shaft blank from the pick-up section on the conveyor below, then transfer unit moves across over the fixture. Left arm then drops to grip and unload the semi-turned shaft, and when it has retracted, the right one follows to insert the blank. When unit returns, left arm descends, releasing its shaft onto exit conveyor. Then one blank rolls into pickup section for next cycle

standard machines

conveyor check the end diameters of passing shafts, stop the drive if any piece is not correctly machined. This avoids damage to the next machine, a copy lathe.

The same type of transfer and loading mechanism is on the lathe, which grips the shaft between centers with a hydraulic tailstock. Tool slides with separate masters travel inward from the work ends, each cutting half the shaft length. Similar gages on the outgoing conveyor inspect shafts enroute to the first grinder.

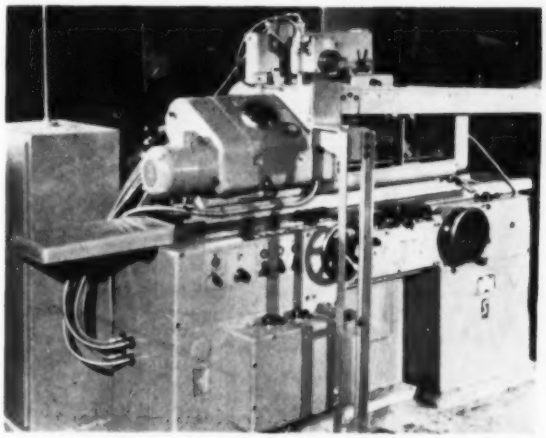
The first cylindrical grinder has a different loading arrangement—shafts are released singly from the inclined storage magazine to drop onto a pair of pivoting arms that lower the work between driving cone and tailstock. Two diameters on one end of the stepped shaft are plunge cut with a profiled wheel. Infeed to size is gage-controlled.

Identical grinding machines

After grinding, work is released and lifted up onto a transverse belt and conveyed to an identical machine that grinds the shaft's other end. This pair of machines face each other in a staggered relationship to avoid reversing the work between the machines. That's because opposite ends of the work are driven and ground in each case.

Both ends aren't ground simultaneously on a single machine with two wheels because this would require a special machine—and East Germany today is concentrating on low-cost automation with standard machines. Here, centerless grinding is ruled out, too, because the shaft's midsection is not ground, and accuracy and imbalance might result.

Storage magazine on final grinder . . .
. . . has a pair of inclined rails gravity-fed from a transverse belt conveyor. Shafts are released singly to drop onto two swinging arms that lower the work between the driving cone and hydraulic tailstock. Gaging head is visible just beyond the positioned shaft



Final cylindrical grinding machine . . .
. . . is paired with its identical predecessor in the line to successively grind diameters on both ends (for pulley and fan) as well as bearings. Shafts are carrried in longitudinally on the belt conveyor from the unloader on the previous machine, are then automatically loaded. Plunge-cut grinding with profiled wheel is gaged with feedback size control. The machine takes work up to 450-mm long and 200-mm diameter, has a 400-mm wheel. Work spindle speeds are stepless from 60 to 400 rpm

Cheaper blanks made by universal die set

Tool cost and die-changeover time are relatively excessive for low-production blanking operations. Here is a proposed tool design that maintains the accuracy of a 4-post die set and permits various interchangeable arrangements of punches and dies

By G R Tindale, South Australia

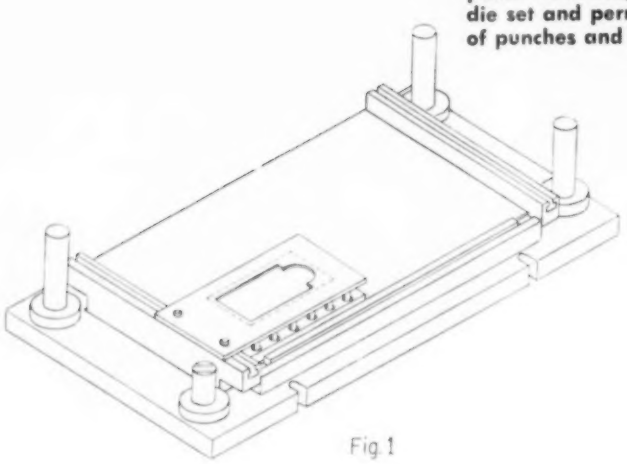


Fig. 1

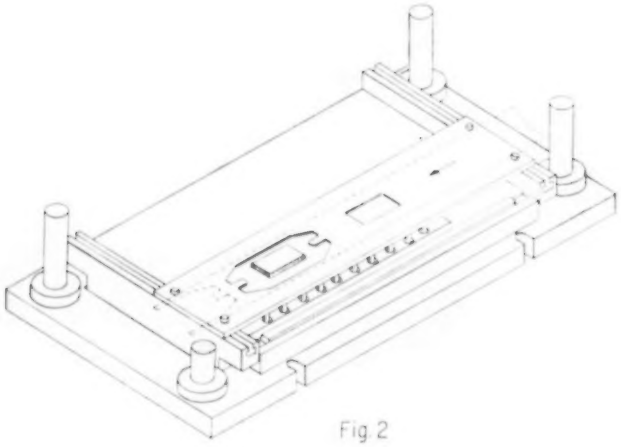


Fig. 2

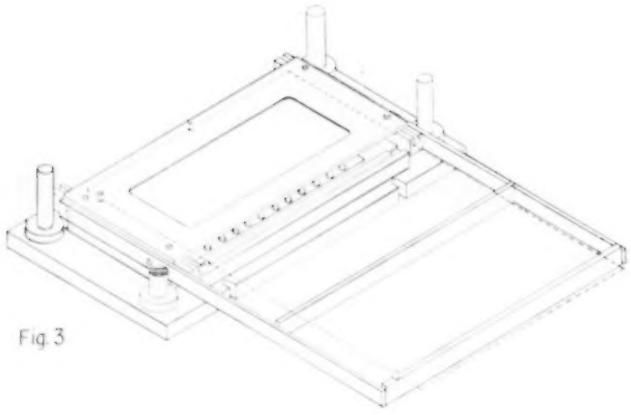


Fig. 3

Production of high-quality blanks requires good tooling. If your quantities are low, however, and die changes are frequent, the die inventory and setup costs can be burdensome.

To get around this problem I designed a universal die set. Simple, low-cost punch and die members can be mounted in this die set in minimum time. Stripper and ejector plates may be mounted in various ways, to adapt the tool to various kinds of work.

As designed, the tool is large enough to cut blanks up to 24x12-in., while allowing sheets 36 in. wide to pass between the guide posts.

The top and bottom shoes are laid out with identical patterns of drilled holes for shoulder screws, and tapped holes for securing punches and dies. Along the front and left-hand edges, the shoes are grooved to take locating keys which are screwed in place at right angles to each other, and against which the punches and dies are lined up. When making the die set, the toolmaker should align the top and bottom shoes by keying them together, face to face, while securing them to their supporting frames.

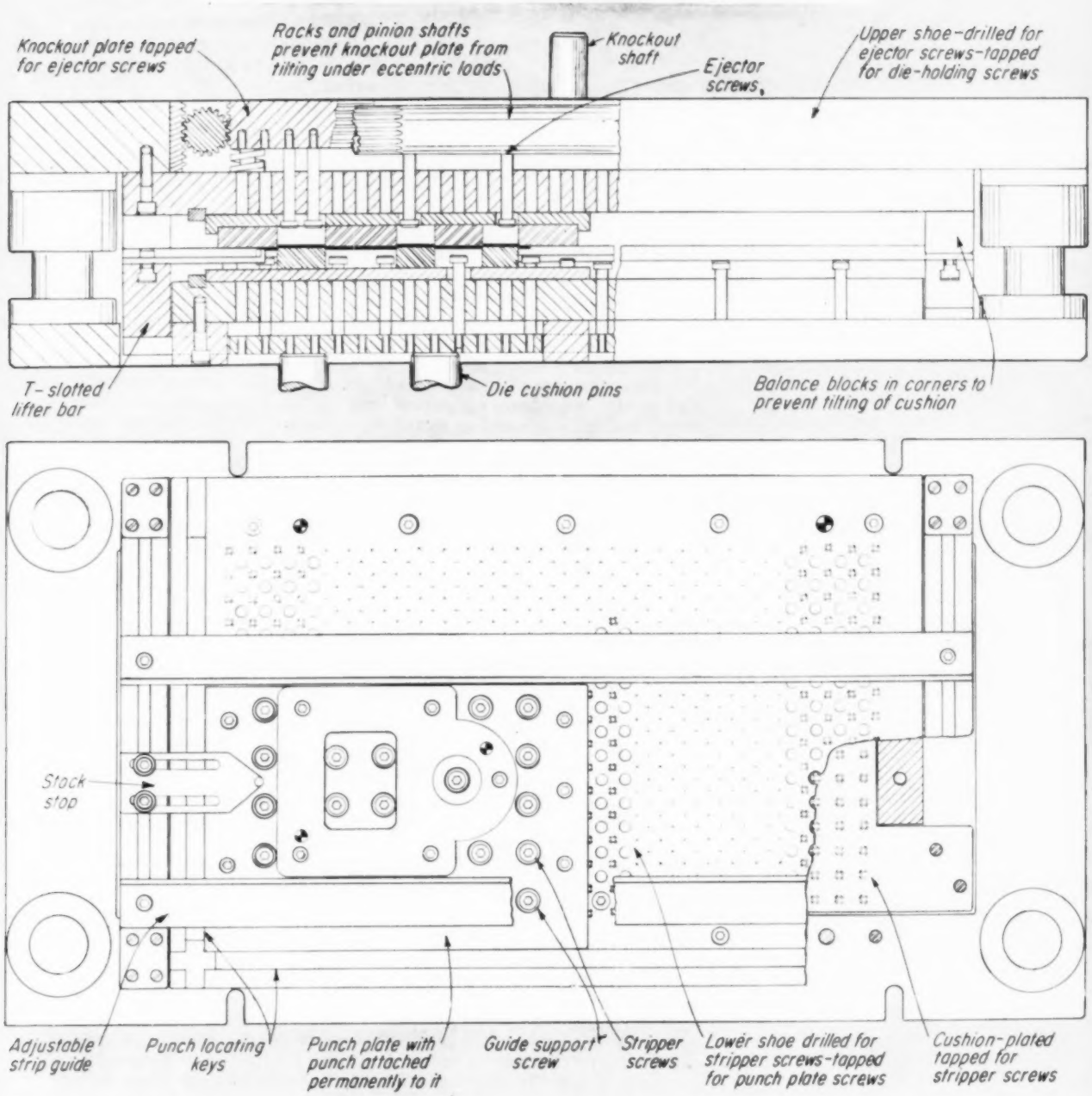
Each shoe is screwed and doweled to a supporting frame, which in turn is bolted to the press table or ram.

Beneath the lower shoe, in the inclosed area of its supporting frame, the cushion plate is free to move vertically while supported on the die cushion pins.

This cushion plate has a pattern of tapped holes which are in line with the drilled holes in the shoe, thus permitting the stripper screws to be secured in place, to rise and fall with the cushion plate.

At each end, the cushion plate carries a T-slotted lifter bar. To these bars are screwed adjustable strip guides, stripper plates, stock stops, or outrigger supports as required. At each end of the lifter bars, there are small removable plates. These plates

A compound die without stripper or ejector plates is shown set up in the universal die set


Knockout plate tapped for ejector screws
Racks and pinion shafts prevent knockout plate from tilting under eccentric loads
Knockout shaft
Ejector screws
Upper shoe-drilled for ejector screws-tapped for die-holding screws
T-slotted lifter bar
Die cushion pins
Balance blocks in corners to prevent tilting of cushion
Stock stop
Adjustable strip guide
Punch locating keys
Punch plate with punch attached permanently to it
Guide support screw
Stripper screws
Lower shoe drilled for stripper screws-tapped for punch plate screws
Cushion-plate tapped for stripper screws

take the pressure from balance blocks attached to the top tool, to insure that the cushion plate does not tilt under eccentric loads. Where a stripper plate is used, these blocks may be taken off, so that the stock will be gripped firmly between the die and stripper plate.

As drawn, the balance blocks are solid, but they could be given a screw adjustment if necessary, to suit various heights of punches and dies.

Above the top shoe, the knockout plate, normally held in its "up" position by springs in the corners, is operated by the positive knockout on the press. This knockout plate likewise has a pattern of tapped holes to match the shoe for the insertion of ejector screws.

Because the positive knockout of the press exerts its force in the center, a plain knockout plate might tilt when eccentric loads are imposed by ejecting "off-center" blanks. This disadvantage has been taken care of by a rack and pinion equalizing device. Along each side and end of the knockout plate, near the corners, rack teeth are cut, all in line on the

Cheaper blanks made by universal die set . . .

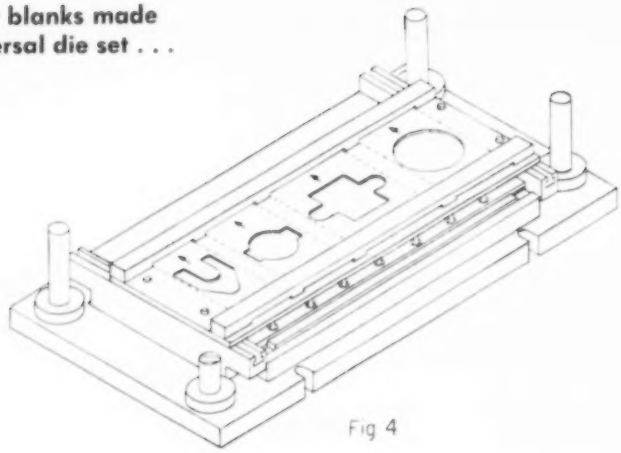


Fig 4

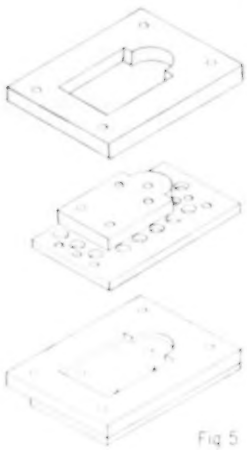
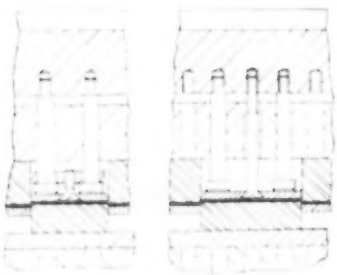


Fig 5



A Fig 6 B

Fig 7

four sides. Corresponding racks are inserted in the upper supporting frame, and these are geared to the knockout plate racks by pinion shafts along all four sides. The teeth at each end of a pinion shaft are in line with each other. Hence, the knockout plate is always supported horizontally, however loaded it may be, and yet is free to move vertically whenever required.

The main drawing, page 123, illustrates a compound blank die used without special stripper or ejector plates. The scrap is stripped from the lower tool by means of standard shoulder screws suitably located around the ends and in the holes of the punch, and by the rabbetted strip guides along its sides. These strip guides, as well as being secured at their ends to the lifter bars, are supported by shoulder screws spaced longitudinally beneath them. Guide-support screws are shorter than the stripper screws, so that the heads of the latter are in the same horizontal plane as the strip supporting surface of the rabbet. A stock stop attached to the left-hand lifter bar completes the locating arrangements for the stock.

At the end of the up stroke of the press, the blanks are ejected from the top tool by the heads of the ejector screws, the threaded ends of which are screwed into the knockout plate.

In cases where the stock is too thin to permit successful ejection by these simple means, stripper and ejector plates must be used. However, these can be made of thin plate, say ¼ in., for cheapness.

The detail sketches, Figs. 1 to 7, pp 122, 124, indicate ways in which stripper and ejector plates may be mounted, and show applications.

Examples of Use

Fig. 1 shows a simple blanking punch surrounded by a light stripper plate attached at one end to a lifter bar, and supported by shoulder screws.

In Fig. 2, a progressive blanking setup has the stripper plate screwed to both lifter bars, the heads of the screws serving as strip guides. No. 2 punch has a locating plate that serves to align the stock for the second stage.

Blanking a large rectangular hole in a 30-in.-wide sheet is the operation shown in Fig. 3. In addition to holding the stripper plate, the lifter bars carry the outrigger support for the sheet.

Fig. 4 indicates a method of attaching several blanking punches to the one punch plate and using a common stripper. Bars along the edges of the stripper are slotted to guide the varying width strips across the tool.

The simplicity of punch and die construction is pictured in Fig. 5. The die here is a single plate, while the punch is mounted on a plate which is drilled for attachment and stripper screws. With the punch and die fitted together, the locating edges may be machined in assembly to insure accuracy of location. No taper relief is needed in the die, because the blank does not pass through it.

In Fig. 6 are shown two methods of securing ejector plates in the top tool. In case *A*, where space is limited, the ejector screws pass through a small attachment plate which has a hole tapped in its center. The heads of the ejector screws are then "sandwiched" between this plate and the ejector plate, which is held in place with a countersunk-head screw. Where more space is available, as in *B*, the ejector plate rests in similar fashion on the heads of the shoulder screws, but it is connected directly to the knockout plate by long countersunk-head screws.

Fig. 7 illustrates the top and bottom tools of a simply made flanging die, together with the workpiece.

The pressure pad in the bottom tool is operated by shoulder screws from the cushion plate, while the sectional view of the top tool shows the holes for the knockout screws which eject the finished workpiece.

Piercing of small holes is not a recommended operation for this die set, because there is a danger of small slugs falling down the holes in the shoe and thus fouling the working parts.

American Machinist
Special Report No. 473 June 1, 1959

How to choose and use Tubing

By W O Nussear, Jr
Superior Tube Company
Norristown, Pa

In making tubular parts, is it better to buy tubing or to drill solid bar stock? The answer obviously depends on whether the right kind of tubing is available for the job. Chances are it is —today, tubing of more than 120 different materials is on the market, including 40 kinds of stainless tubes alone.

But other factors must be considered, too. Temper availability is one. Bar stock, of course, comes in a wide range of tempers, but so does tubing today—in such standards as half-hard-drawn, full-hard-drawn and soft-annealed, plus such intermediate tempers as one-quarter-hard, three-quarters - hard, hard - drawn and stress-relieved.

Non-standard tempers for tubes can be held to a minimum spread of 10,000 psi for ultimate tensile or yield strength, and a spread of 10 points Rockwell B or seven points Rockwell C. Many analyses can be supplied in such special tempers as normalized, Condition N (for AISI Type 4130) and temper 3 P (pearlitic grain structure).

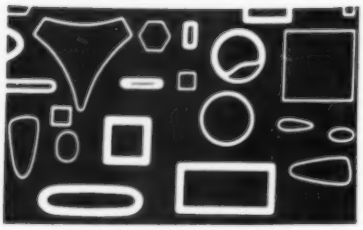
Because temper can be controlled as easily in production of tubing as in bar stock, tubing here has an advantage in that drilling of bar stock can lead to work hardening on some types of materials.

What about costs? Tubing is sold by the foot (or 100 feet), bars by the pound. Costs may be compared by translating the cost-per-lb into cost-per-ft—simply by multiplying the cost-per-lb by the pounds per foot.

Tubing costs may often be reduced by specifying welded and drawn instead of seamless. The former type should undergo at least a 50% reduction in cross section (15% of it in wall thickness) by cold drawing and should be given at least two solution anneals. Cold work and annealing cause the weld area to recrystallize, making it equivalent in ductility, mechanical properties, and corrosion resistance to the parent metal.

Even assuming that bar stock costs less per foot, it must be drilled or reamed to produce a hole, and this involves machining time, labor costs, scrap handling and, of course, machines to do the job.

Generally speaking, the longer the piece to be drilled, the more tendency for the drill to run off, and the harder it is to maintain concentricity. Some pieces drilled in turret lathes or screw machines must have the OD



turned to obtain the same concentricity as that of equivalent tubing.

Cold-drawn tubing on the other hand can be produced to close eccentricity tolerances, regardless of the length of tubing. Commercial eccentricity is limited to 10% (20% total indicated runout) of the specified, or calculated average, wall. If necessary, this tolerance can be reduced to a guaranteed 50% of commercial, or closer.

Other problems may arise in drilling of long pieces. For instance, if heat treating is necessary after drilling, long drilled parts have more tendency to distort. As a rule, bars more than 12 inches long require gun barrel drills, plus special equipment for maintaining cutting oil pressure.

Drilling thin walls

Drilling of thin-wall parts is also difficult in that it can cause distortion and stresses. And if the drill runs off even slightly, it can go through the wall. For these reasons, it is not generally practical to drill bar stock when the tube wall is less than 3/32 in.

Drilling of very small sizes of bar stock has its problems, too—even though drills are available in diameters as small as 0.0135 in. It is impractical in most cases to drill holes less than 0.035 in. diameter because such very small drills tend to break or bend unless they are quite short.

Certain metals require special care in drilling. Drills for austenitic stainless steel, for example, must be short, must be run at adequate speed, and must be kept clear of chips. Such drills should be reground to about a 130° included angle instead of the usual 118°. After the chips are cleared, the drill should re-enter the hole with fast positive feed. This allows it to get under the glazed surface left by the previous cut.

When using bars for production of tubular parts, it may also be necessary to perform a finishing operation on the drilled hole—either to bring it to desired size, or to obtain a smoother surface finish, or both, and this increases production costs.

Moreover, honing is required if surface roughness is to be held to the 16-32 micro-inch range. This is extremely hard to do on holes under ¼-in. diameter.

The bore of cold-drawn tubing, on the other hand, can be produced in almost any desired size increments. And tube mills carry a large inventory of dies and mandrels, covering almost any size that may be specified. They can easily grind and polish a set when an odd size is needed. Drills, however, have increments beginning with 0.001 in. in the smallest sizes, increasing to 0.009 in.

A roughness level of 250 micro-inches on the ID of all tubing should be guaranteed by tubing makers, who can easily produce to a micro-inch level of 63, or much less, by sampling. One of the latest finishes is bright pickling—a finish equivalent in ID and OD reflectivity to electropolishing.

By comparison, producing a 125-in.-maximum micro-inch roughness by machining requires relatively high speeds and fine feeds with light cuts. In most cases it is necessary to ream to get a finish comparable to that of tubing.

Tubing has a further advantage in that drawing tubing over a mandrel has a burnishing effect—producing a smooth and even surface in contrast to the periodic undulations characteristic of machined stock.

Potentials of shaped tubing

What about tubular parts which have other than round shapes on the OD or ID or both? Here very considerable savings are possible through the use of shaped tubing. Indeed, without expensive broaching operations, shaped IDs on tubular parts are possible only by the use of shaped tubing.

The drawing on p125 shows a few of the shapes made in seamless tubing. They are produced by cold drawing the material to the correct round, then forming by means of shaped rolls (Turks-Head method) or by shaped dies and mandrels. The latter is the most expensive method but is almost unlimited in the variety of shapes which it can produce.

Even if the part is step tapered, it can often be produced more economically from tubing. Step-tapered tubing, made by drawing round tubing on successively smaller dies and mandrels, is now commonplace.

Also influencing production costs of tubular parts is the ease of handling longer lengths of lighter-per-foot tubing on automatic machines and the fact that the coolant can be applied both to the interior and the exterior of tubing. Generally, the machining required on tubing is a comparatively simple, easily cooled, low-temperature operation with high cutting speeds and long tool life.

Down to cases

The production savings made possible by the use of tubing in producing tubular parts is heavily underscored by case records of fabricators who have switched from solid stock to tubing.

At the plant of a bottling machine manufacturer, for example, the use of precision-drawn tubing has cut machining costs by 40 to 65% in production of valve nozzles.

The nozzle and its casing make up a two-piece valve. The nozzle must turn freely within the casing, yet fits so closely that carbonated gas cannot escape between them.

Originally, this company fabricated the parts from solid bar stock by drilling and reaming to get the required size tolerance and finish. Rejections of nozzles ran to 50% and nozzle casings to 20%.

Switching to tubing cut the rejects to virtually zero and tool costs by 80%. In addition, the finish on the inner surface of the casing has been improved from readings of 60 to 65 micro-inches to between 16 and 20. The company now specifies 32 micro-inches as the maximum acceptable surface roughness.

An aircraft products manufacturer, found that production of type 4130 chrome molybdenum aircraft bushings (100 micro-inch maximum surface roughness on the ID) was extremely difficult when it made them from drilled and reamed bar steel. Although the best reaming methods were used, rejects averaged 30 to 35%. This, of course, added to production costs.

Cutting costs with tubing

Substitution of tubing brought an immediate drop in rejects to virtually zero. This, together with the elimination of drilling and reaming, cut production costs materially.

Drastic savings in manufacturing costs were also realized by a dental instrument company when it replaced bar stock with tubing in mak-

ing parts for its straight hand drill. The parts are a spindle, the bearing sleeve in which the spindle fits, and the outside sleeve.

When the parts were made from bar stock, the plant began with short pieces of bar, drilled the blanks, then swaged down the drilled blanks to get the length required for the piece. Swaging was necessary when using solid bars because the finished parts were too long to permit drilling bar stock of that length without drill runout.

By using tubing, the company saved 12 expensive operations—mostly swaging, with annealing between swaging—in making the spindles; nine operations (again mostly swaging) in making the bearing sleeves, and seven swaging operations in making the outside sleeves. According to the dental firm's production department, this resulted in "tremendous savings in swaging and other tool costs."

If you'd rather buy the hole— . . .

If you *are* convinced that it is more economical to buy the hole than to make it, a number of steps can be taken to cut production costs still further. These may be roughly classified into (1) good tubing specification practice, and (2) good fabricating practice.

When specifying the tubing, careful selection of material may permit a big difference in machining costs without sacrificing other required properties. The wide choice of materials now available in tubing makes it possible to be much more selective than heretofore.

In the major classes of tubing materials (carbon, alloy and stainless steels; nickel and nickel alloys) there are naturally some analyses that are more machinable than others. Among stainless steels, for example, type 303 (an 18-9 grade with selenium added) is much more machinable than others, as can be seen by the machinability ratings of the various grades in Table II. The machinability of other materials is shown in Table III.

In the carbon steels, both lead-bearing and sulphur-bearing grades —the so-called free machining grades —are furnished in tubular form. These include sulphur-bearing type C-1118 and lead-bearing type C-1020. Both types have excellent machinability, but they are difficult to process into tubing which has a smooth ID. Superior has found that sulphur-bearing carbon steels are the most troublesome from this standpoint. At

TABLE I. Commercial size tolerances on small tubing.

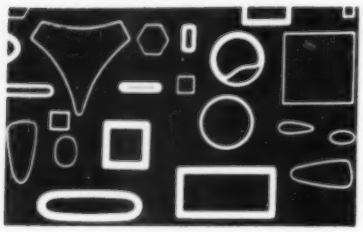
OD Range	OD	ID	Wall
Up to, but not including 3/32" (0.09375") OD	+0.002" −0.000"	+0.000" −0.002"	±10%
3/32" to, but not including 3/16" (0.1875") OD	+0.003" −0.000"	+0.000" −0.003"	±10%
3/16" to, but not including ½" (0.500") OD	+0.004" −0.000"	+0.000" −0.004"	±10%
½" to, but not including 1½" (1.500") OD	+0.005" −0.000"	+0.000" −0.005"	±10%
1½" to, and including 2½" (2.500") OD	+0.010" −0.000"	+0.000" −0.010"	±10%

TABLE II. Machinability rating of various types of stainless steel compared with Bessemer screw stock No. B1112, annealed temper.

Material	Rating (%)	Material	Rating (%)
303	70-80	348	40-50
304	40-50	403	50-60
305	40-50	410	50-60
309	40-50	430	40-50
310	40-50	430Ti	50-60
316	40-50	446	45-55
321	40-50	502	45-55
347	40-50		

TABLE III. Machinability rating of carbon and alloy steels and nickel and nickel alloys compared with Bessemer screw stock No. B1112, annealed temper.

Material	Temper	Rating %
CARBON STEELS		
1010	#3	42
1015	#3	50
1115	#3	75
1020	#3	58
1025	#3	58
1035	#3	64
1045	#3	57
ALLOY STEELS		
4130	#3	52
4140	#3	48
4150	#3	45
52100	#2	65
NICKEL AND NICKEL ALLOYS		
NICKEL	#2	15/25
	#3	40/55
MONEL	#2	18/30
	#3	50/65
K MONEL	#2	15/25
	#3	45/60
INCONEL	#2	12/20
	#3	35/50



the same time they are so brittle that extremely low reduction in drawing is required to avoid ID cracks.

The machinability of carbon steel jumps about 15% when lead is added. Tools can be used at 15 to 20% faster speeds, with heavier feeds, less tool wear and better finish. The addition of lead has little effect on the mechanical and physical properties of the steel.

Eliminating unnecessary machining

The fact that leaded carbon steels cut clean with a smooth finish is of special interest when estimating production costs, because it minimizes (sometimes eliminates entirely) final machining operations which may be required with unleaded steels. This is also true of deburring and grinding. The improved surface finish is particularly important in applications where machined parts are case hardened and then polished and buffed to a high luster. Unleaded steels require either longer polishing time or expensive grinding operations to obtain the desired surface finish.

In addition to type C-1118 carbon steel, sulphur-bearing or selenium-bearing tubing materials are also available in Monel metal and type 303, type 416 and type 430 F stainless steels.

How to evaluate tubing

Whether or not a free-machining grade is specified, it pays to carefully evaluate the tubing materials you are now using. A change may either improve machinability and thus reduce production costs or it may retain good machinability while improving other properties. Here are examples:

- A lock maker had been using type 430 straight chromium stainless steel tubing for making spindles for his manipulation-proof safe locks. When he changed to type 303 austenitic stainless steel tubing drawn to a restricted tensile range of 100,000 to 115,000 psi (¼ hard), threading production was increased 30%. The increased production was accompanied by longer tool life.
- A California firm sought a material for cable bushings for aircraft spark plug terminals which would not corrode like brass. However, since the bushing must be both threaded and crimped it had to combine good machinability with good workability. It was found that type 304 tubing, drawn to a special one-quarter-hard temper, was unaffected by heat or electrolysis and at the same time could be threaded and crimped without difficulty.
- A company which makes cartridge heating units for insertion in holes drilled and reamed in heating dies, platens, process machinery, molds, melting pots and other equipment, had used brass tubing for sheaths for the units. The thermal expansion of the metal was such that the unit had a tendency to bind in the hole. Replacement with 30% cupro nickel tubing (which has a lower thermal expansion) solved the binding problem. Furnished half-hard, the cupro-nickel tubing also proved to have good machinability and resisted denting.

Temper specifications

It will be noted in most of the case histories cited that the tubing was furnished to a special temper. Investigation of temper availability may prove exceptionally rewarding in the search for lower production costs, particularly because specification of special temper costs no more than specifying standard tempers. Use of special tempers often provides a better balance between machinability and other desired properties.

All tempers, whether standard or special, are obtained through a combination of cold drawing and heat treatment. Temper 1, soft annealed, results from process annealing (subcritical) the finished size prior to straightening. All other tempers are obtained by cold drawing a specified amount to finished size—the greater the reduction the higher the ultimate tensile strength, yield strength and hardness but the lower the elongation (ductility). These tempers are supplied in the "as drawn" condition without further heat treatment.

Distortion in hard-drawn

When hard drawn (Temper 3) tubing is required, distortion may be a problem. If so, the tubing should be specified as "hard drawn stress relieved." This is particularly true when long lengths of hard-drawn tubing, which might warp during fabrication, are required. Stress relieving is available in all tubing analyses.

For low and medium carbon steels and alloy steels, Temper 3P is usually the best from a machining standpoint. This is hard-drawn tubing which has been given a normalizing

TABLE IV. Relation between grit numbers, micro-inch finishes and machined surfaces.

Grit Numbers	Micro-inch Range	Machined surface
500	4-16	Refined, very fine and high quality surfaces produced by special finishing operations, fine cylindrical grinding, emery buffing, honing or lapping.
320	10-32	32 micro-inch finish is a high-grade machine finish requiring close control when produced on lathes, shapers, milling machines, etc.
240	15-63	63 micro-inch finish is a good machine finish produced under controlled production procedures using relatively high speeds and fine feeds in taking light cuts with well-sharpened cutters.
180	85 Max	
120	125 Max	A medium, commercial machine finish in which relatively high speeds and fine feeds are used in taking light cuts with well sharpened tools.
60	250 Max	Coarse production surface resulting from very coarse surface grind, rough file, disc grind, and from rapid feeds in turning, milling, shaping, drilling, boring, grinding etc.

anneal, resulting in a pearlitic microstructure.

Tubing temper may be specified in three ways: (1) temper number, (2) Rockwell hardness and (3) tensile strength. The temper numbers designated may be either the standard ones (1, 2 and 3) or intermediate tempers such as one-quarter and three-quarters hard. Temper number is the temper designation usually given.

Specification of temper by Rockwell hardness is not desirable unless there is complete understanding between the customer and the mill regarding the method to be used for determining hardness. Tube size, the ratio of OD to wall thickness and the technique of hardness testing can all greatly influence recorded hardness values. Furthermore, hardness values taken on the outside surface will differ significantly from those taken on the inside. And values taken on a ground flat may be quite different from those taken on a round surface.

If the application makes it desirable to have closer temper control than is possible with temper number designation, the best specification is by tensile strength. The tubing can be held to a minimum spread of 10,000 psi for either ultimate or yield strength, and the tubing's tensile properties can then be easily and accurately measured.

Intermediate tempers

Designation of intermediate tempers may bring important production savings. This is particularly true when a combination of forming and machining operations is to be performed on the same piece, requiring a not-too-hard temper for the forming operation and a not-too-soft temper for the machining. Or it may be necessary to strike a balance between desired hardness of the finished part and the best hardness for either machining or forming.

In fabricating stainless-steel tubing, there is a larger difference in machinability for the various machining processes and grades of steel than for any other group of metals. For many purposes machinability is better in cold-worked tubing, while for others, such as drilling very small holes, an annealed tube may prove more satisfactory. Where machinability is an important consideration it is best to experiment with samples from the tube mill.

It should be remembered that when austenitic stainless steel is machined or formed it will tend to work harden locally. This may materially lower its corrosion resistance so that annealing after fabrication may be advisable.

Since so many tubular parts for purely mechanical functions are made of carbon and low-alloy steel, the machining characteristics of the different types deserve special consideration when drawing up specifications.

To simplify, carbon and alloy steels may be grouped into three carbon ranges: low carbon (0.08 to 0.30%); medium carbon (0.30 to 0.50%), and high carbon (over 0.50%).

Less carbon, more machining

Generally speaking, the lower the carbon content of plain carbon steel tubing, the more difficult it is to machine. Ferrite, which is essentially pure iron and is the primary constituent of low-carbon steel, is extremely soft and ductile. As it machines, the chips tend to tear away from the stock, leaving a rough surface. Gummy by nature, the material sticks to the cutting edge of the tool, thus creating excessive friction and lowering tool life.

The best way to overcome this is to specify hard-drawn Temper 3 from a full anneal. The higher the hardness and the finer the grain size the easier the metal will be to machine.

In the medium carbon range, the most suitable microstructure for machinability will depend primarily on the type of machining to be done. A uniform pearlitic (lamellar) structure obtained by full annealing, or a fine pearlite developed by normalizing, is best for forming, drilling and broaching. The laminated pearlite structure is desirable for both rough and finish cutting because a smoother surface results than with a spheroidized structure. The latter, however, is satisfactory for turning operations.

As in the case of low-carbon steels, the machinability of medium carbon steels is improved by cold drawing after annealing.

In the high-carbon range, a lamellar-pearlitic structure is best for light cuts and where a smooth, clean surface is required. For rough cutting operations, a spheroidized structure permits high speeds with long tool life.

If both rough and finish cutting are done, it is advisable to specify a spheroidized structure for the rough cutting, then box or cycle anneal to convert it to a pearlitic structure for the finishing operation. When such intermediate heat treatment is not practical, a partially pearlitic or partially spheroidized structure may be specified as a compromise.

For very high carbon steel with a carbon content of 0.70% or more, the most versatile structure for both rough and finish cutting in all types of operations is one that is completely spheroidized. A lamellar-pearlitic structure will produce a smoother surface, but tool life will be definitely shortened.

It has been found that temper 3P (with pearlitic structure) is best for low- and medium-carbon steels and low-alloy steels. It is particularly useful for applications requiring a very smooth ID where it is hard to furnish free-machining carbon steel tubing with a smooth ID.

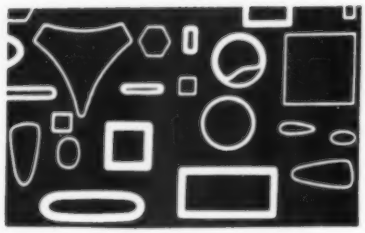
As a case in point, a manufacturer of textile machinery was having trouble with a tubular thread guide made from free-machining carbon steel (first sulphur-bearing, then lead-bearing) because of the difficulty in achieving smoothness of bore. Yet good machinability was required because the part was threaded. By replacing with type MT-1020 carbon steel furnished in temper 3P he had no further trouble with surface finish on the bore. At the same time he switched to thread rolling instead of thread cutting, and this, together with the change in analyses, reduced his machining time from 1 minute, 40 seconds to 14 seconds. And the rolled threads were of better quality than the cut ones.

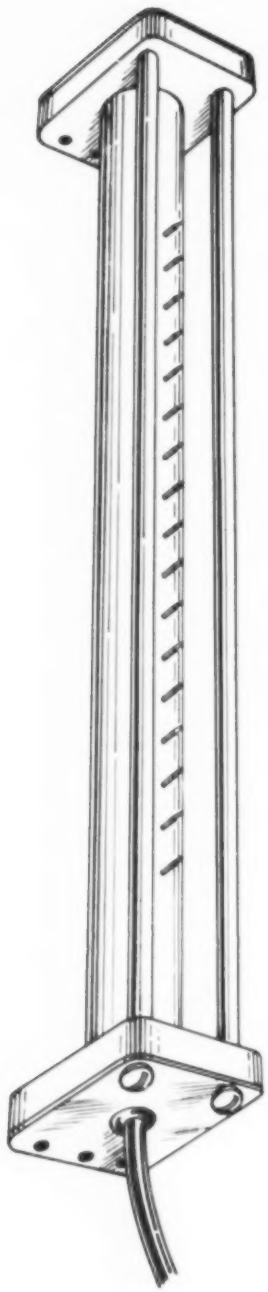
Some rules of thumb

Few hard-and-fast rules apply to specification of temper for tubing. A general principle, however, is to order tubing as hard as is compatible with reasonable tool wear. Very hard materials (such as high-carbon steels) should not usually be ordered in a hard temper. On the other hand, softer materials should carry a harder temper designation than others. And the more the material is capable of being hardened, the lower the temper needed in the raw stock.

Other factors, however, may completely upset even general rules about temper designation. For example, in parts made from very small tubing (below 1/8-in. dia), the rigidity of the tubing (ability to be machined without bending) is a primary consideration, so that it may be advisable to specify a harder temper than is required for best machinability.

Hard, soft or intermediate tempers may be specified for either pearlitic or spheroidized microstructures. Often it will pay to try various com-





binations of hardness with microstructures to find one which gives optimum results.

Special tolerances

Another step which can often reduce production costs is to specify special tolerances for size, concentricity or depth of surface imperfections. Closer - than - commercial tolerances on these specifications of course cost extra, but the production savings are frequently many times greater than these extra costs. Or the improvement in product quality may make the special tolerances worthwhile. Here are some examples:

- A manufacturer of ticket and label marking machines had been ordering commercial-tolerance tubing in sizes from 0.1885 in. OD x 0.1285-in. ID for the smallest to 0.501-in. OD x 0.422 in. ID for the largest. When he switched to tubing with OD tolerance ⅛ of commercial and ID tolerance ½ of commercial he paid about 10¢ per foot more for the tubing. But the elimination of assembly problems, reduction of production costs and speedup in deliveries brought so many savings and benefits in customer relations that the extra tubing cost was considered negligible.
- A watch manufacturer orders small tubing—0.052-in. OD x 0.015-in. ID—which he fabricates into center arbors for the pinion of sweep second hands by a series of tricky screw machine and swaging operations. Close concentricity must be held throughout the entire production cycle. The production gets off to a good start because the company specifies tubing with concentricity held within 5% of single-wall thickness, compared to the commercial 10%. It also specifies ½ commercial tolerance on tubing size. With comparatively small increase in material costs it is able to meet the precision standards of the watchmaker's art, with minimum rejects.
- A manufacturer of portable laboratory mixers found that by specifying Monel tubing to ½ commercial concentricity tolerance he could gun drill in one operation instead of two. The production savings greatly outweighed the cost of the extra-close tolerance. This company also specified that the hard-drawn tubing be stress relieved to prevent warpage of the long shafts while undercutting the OD and knurling on a turret lathe and forming the OD on a tracing lathe.

Special tolerance on tubing size costs no more than commercial tolerance — providing the tolerance spread is not made tighter but is only shifted from the plus to the minus side, or vice versa. In fact, freedom of choice in applying the tolerance to the plus or minus side often eliminates the need for closer-than-commerical size tolerances and thereby saves on tubing costs.

Often, too, relaxing the specifications in some respects will make it easier to meet the specifications which really count. This is illustrated by the experience of a telescope manufacturer in the procurement of telescoping tubing for a mirror support. The telescope is focused by sliding the outside tube with the mirror mounted on it over the inside tube. The principal concern was to get just the right amount of clearance between the two tubes to prevent either binding or wobble. Rather than tightening the tolerance on the ID of the outside tube and the OD of the inside tube, it was found that these dimensions could vary within reasonable limits and still meet specifications simply by matching up the right combinations of inner and outer tubes, so that plus and minus deviations on the telescoping dimensions would compensate for each other.

Economies can also be made by careful study of the cost of various tubing length specifications compared to production costs using these lengths.

Length specification

Commercial random lengths, which carry no extra charge, are subject to a 7-ft spread in a range of 5 to 24 ft in sizes ⅛-in. OD and larger; long random lengths to a range of 17 to 24 ft. Random lengths are perfectly

Case history: tubing vs bar stock . . .
By using tube instead of bar stock, the manufacturer of this shockless static bar saved 41¢ per ground rod by eliminating drilling on both ends. This saving was effected even though the Type 430 stainless steel tubing (0.1325-in. OD x 0.166-in. ID) cost $66.88 per 100 ft as against $17.42 per 100 ft of equivalent bar stock

satisfactory for many operations, particularly where the finished part is short and hence scrap loss is not great.

Multiple lengths (tubing which is furnished in multiples of a predetermined length) fall into three size ranges: multiples under 3 ft.; multiples 3 ft. to under 6 ft.; multiples 6 ft and over. Extras apply to this length specification, but the savings in scrap loss (resulting from cuts coming out evenly) may offset this cost and even permit substantial overall savings.

Straight cut lengths can be supplied in any length up to 39 ft and with tolerances of a small fraction of an inch on the length. This length specification deserves special consideration when adequate tube-cutting facilities are not available in the fabricator's plant or when present cutting facilities are overtaxed. Because of its experience and special equipment for tube cutting, the tubing mill can often supply cut lengths at less cost than the customer can cut tubing to length in his own plant.

Coiled tubing lengths can often permit substantial production savings when using automatic machines with high production rates requiring continuous feed. Depending on the size of the tubing, coils can be supplied in maximum lengths of 39 to 500 ft. Certain types of tubing, such as capillary, are available in even longer lengths.

Surface defects on commercial small-diameter, cold-drawn tubing are held to 10% of total wall thickness. This can be held to 5% of total wall thickness when specified. The extra cost of the lower defect level is often justified because of the elimination of grinding or other surface finishing operations which might otherwise be required for certain applications.

One of the most obvious ways to cut production costs on tubular parts is to reduce the need for machining by procuring tubing which has been shaped either over its entire length or on the ends or with a finish which meets specifications without further processing.

Shaped tubing

A surprisingly large number of fabricators fail to take advantage of the wide variety of shapes in which tubing is furnished. The variety of shapes which can be produced is almost unlimited, and, because shaping is a continuous process, the cost of forming the metal to shape while in tubular form can be a fraction of the cost of machining the shape on the finished part. This is particularly true when parts are mass produced.

Shaped tubing can be made throughout the same size range as round tubing. To determine whether the shaped tubing size is within the round tubing production limits, the approximate round size can be computed by using the following formulas:

- Squares: Multiply length of any side by 1.273.
- Rectangles: Multiply length of large side by two, add length of small side, divide by 3.1416.
- Hexagons: Multiply distance across flats by 1.103.
- Flats, ovals and ellipticals: Subtract the minor OD from the major OD and add the minor OD multiplied by 3.1416.

The entire length of tubing, or only a part of the length, can be shaped. Step tapering can also be done. In most cases the shaped tubing can be furnished in the same tempers as round tubing and with the same surface finishes. Maximum length supplied is about 29 ft.

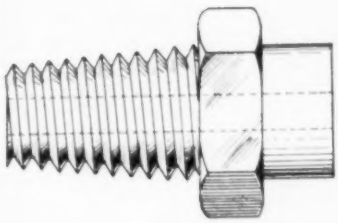
The Turks-Head method of producing shaped tubing uses four rolls which overlap. This method may be used for forming squares and rectangles up to 1⅛ in. on a side. With a plug mandrel, it may be used for tubing with square OD and round ID; round OD with square ID, if the ID is large enough for a plug mandrel which is 3/16 in. in diameter or larger, and triangles.

Since rolls cost about half as much as dies and since die-shaping almost always requires a mandrel as well as a die, the Turks-Head method is the most economical for shaping tubing. And the chances are greater of a mill having rolls for a particular shape rather than dies. The Turks-Head method produces shaped tubing to commercial tolerances. Dies and mandrels, however, will produce to closer tolerances when required. Moreover, some shapes, such as hexagons, can be produced only with dies.

End-formed tubing

Tubing may also be formed on the end by a variety of means. At Superior Tube, end-forming is available on tubing from ⅛-in. to 1-in. in diameter. The size of the tubing which can be end-formed depends upon the tubing material, wall thickness and type for forming desired. Types of operations which can be handled are beading, flaring, flanging, sinking, expanding, reducing, double-lap flaring and double-lap

Producing a part from tubing isn't *always* cheaper than from bar stock



MANUFACTURE OF THIS PLUMBER'S COUPLING FROM TUBING INVOLVED:

X Cutting the tubing to developed length
X Pressing to form the profile
X Threading

Four operators and an inspector were required to do the job, producing 600 pieces per hour. The carbon steel tubing cost about 70¢ a pound, and about 10 pieces could be made per pound of tubing—or 7¢ per piece.

●

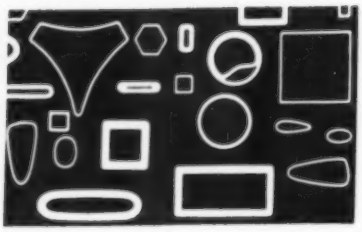
PRODUCED FROM BAR STOCK:

Material cost about 9¢ a pound, with about seven pieces produced per pound, for a cost of around 13¢ per piece. BUT . . . the part was produced by upsetting, using a multiple tool setup. Entire sequence of operation was automatic, required only one operator, and inspection was automatic too. The rate: 4000 pieces per hour.

●

IN THIS CASE PRODUCTION FROM BAR STOCK WAS CHEAPER BECAUSE:

X Bar stock in this size comes in coils and the entire operation is automatic.
X The upsetting method can be broken down into simple steps. Thus the production rate is much faster than press-forming tubing.



flanging. Forming can be done up to 2 in. from the end of the tube.

One of the most promising means of cutting production costs on tubular parts is a careful evaluation of the surface finish specified on the tubing stock. Specification of a better surface finish on the tubing may pay for the extra cost many times over by the elimination of grinding, honing and other finishing.

Surface finishes

Surface finish is designated either quantitatively or qualitatively. The quantitative designation is by micro-inches of surface roughness, using tracer type instruments. Qualitative designations use descriptive terms.

As a result of work in micro-inch measurement of tubing surface roughness, micro-inch surface finish can now be produced to certain guaranteed limits. As a guide to the relative smoothness of micro-inch finishes, the relation between grit numbers, micro-inch finishes and machined surfaces is given in Table IV.

The small diameter tubing industry furnishes tubing with surface finish to micro-inch specifications only when so designated by the customer. Although this is a growing practice, the great majority of tubing orders specify surface finish in qualitative terms.

The two most common surface finishes supplied on small tubing are bright and pickled. These and other standard surface finishes are offered on all commercial products:

- Bright finish: Offered on all tubing regardless of analysis and size, it applies to the outside surface only and only on straight lengths to a maximum of 39 ft. It is produced by a combination of pickling and pulling the tubing through tungsten carbide dies on the final reduction draw. The extremely hard tungsten carbide dies wear less than dies used for breakdown reductions, therefore produce a smoother surface. Bright finishes average less than 63 micro-inches in surface roughness.

- Pickled finish. The finish has a fine, satin appearance which makes it more desirable for some applications than a bright finish. It is available on all tubing analyses and on all sizes down to 3/16-in. OD. It is applied on both the OD and the ID of the tubing. Both straight lengths up to 39 ft and coiled lengths can be pickled finished. Pickled finishes should average less than 125 micro-inches surface roughness.

- Polished finish. Polished finishes are available on the outside surface of all tubing analyses up to a maximum length of 30 ft and with outside diameters from 0.032 to 1.5 inches (extremely light wall tubing may not be supplied with this finish). Grit sizes from 60 up to and including 500 are used. Mechanical polishing not only produces a finish of the required smoothness but also removes minute surface defects and imperfections.

- Tumbled finish. This is the smoothest finish offered on the OD of tubing. On stainless steels and nickel and alloys, the finish has a mirror-like appearance. The process removes burrs as well as producing the extremely smooth finish. It is available on cut lengths of 3.5 in. maximum. Size determines whether the ID surface can be affected by the tumbling process.

- Sanitary finish. Produced by drawing tubing over a stationary, highly polished, tungsten carbide mandrel plug, this finish is also sometimes referred to as burnished ID or dairy finish ID. The bright, extremely smooth and uniform finish is easily cleaned and sterilized. It is restricted to 24-ft maximum lengths, 0.065-in. maximum wall and to the minimum ID's shown in Table IV.

- Bright pickled: This new finish is produced by a chemical treatment which uses heavy mineral acids plus a toner. It is available on stainless, Monel and nickel tubing in lengths up to 4 ft. maximum and with ID's to a minimum of ¼ in. With increasing demand, longer lengths may be furnished.

Bright pickling was developed in answer to the need for a bright polish (equivalent to electropolishing in reflectivity) but which could be produced on the inside of the tubing as well as on the outside (electropolishing is limited to outside surfaces). Bright pickling can be done on tubing which has either the commercial bright finish or the pickled finish.

One final tip to cut costs at the specifications end: Order tubing as close to the final size of the finished part as machining operations will permit. Basically, this is governed by the allowance which should be made for cleaning up surface defects.

Other ways to cut production costs on tubular parts are inherent in good machining and forming practice and apply whether the raw stock is tubing or bars. Sometimes a change in method can bring important savings, as in the case of the textile machinery manufacturer who not only reduced production costs but also improved quality by changing from thread cutting to thread rolling in the manufacture of thread guides. A careful study of machining and forming practices, taking a cold, objective look at past practices, may prove highly profitable.

Precautions should also be taken to hold the work rigid against the tool. This is particularly important when machining light wall tubing. Devices such as expanding mandrels, wood contour blocks and nesting in contour fixtures are both economical and practical.

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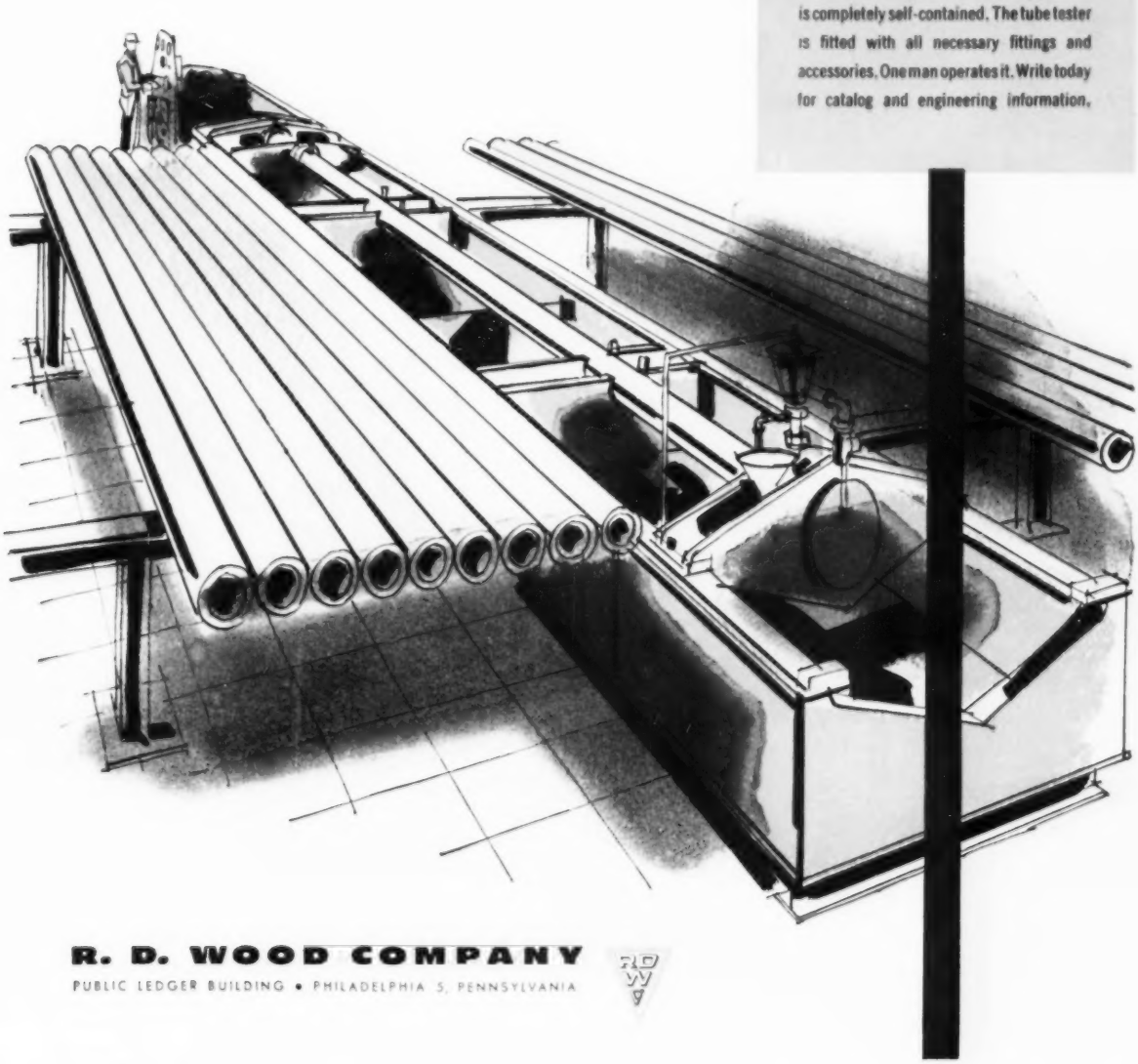

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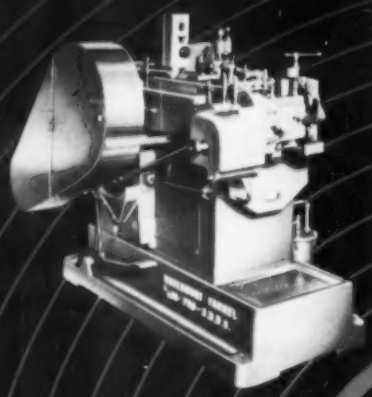

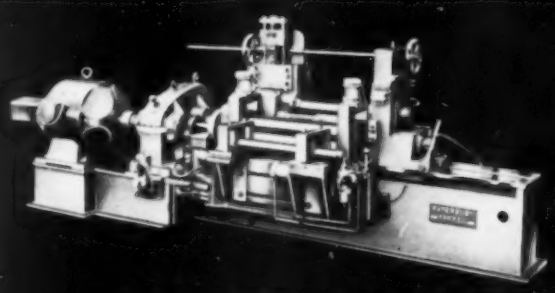

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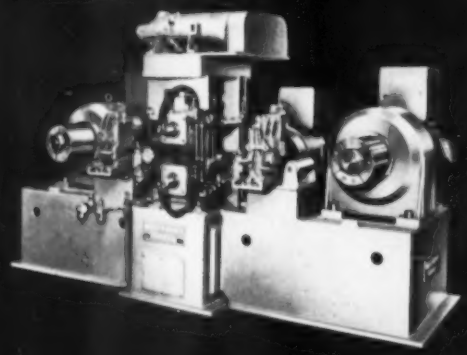

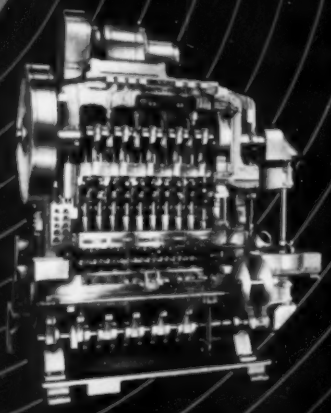

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COMPOUND ANGLES—I

By D E Sweet

Attempts to derive formulas and tables for accurate computation of compound angles can be discouraging. Each case is usually presented in a manner such that it is often easier to consider each problem separately. There is one case, however, that can be standardized to the extent that formulas and tables can be a big help. An example is shown in Fig. 1. Here an angle is to be relieved down and away; it could be found on a cutting tool (for example, a counterbore blade).

Because the "down" and "away" angles are usually arbitrarily selected, the tables and charts given will aid the computation for the true angle. For convenience in using the table and chart, the "down" angle is designated as the "tipping angle" and the "away" angle as the "turning angle." The case angle A is tipped to angle ϕ and then turned to angle α; the resultant angle is the true angle or T.

In the table, constants are given for combinations of "tip" and "turn" angles from 5° to 45°. There are two constants for each combination, namely, constant 1 and constant 2.

To determine the true angle (using table)

Rule: multiply constant 1 by the tangent of the case angle A and *add* constant 2. The result of this addition is the tangent of the true angle.

If it is necessary to compute constants for tip-turn angles not given in the table, they can be found in these formulas:

Constant 1 = $\cos \alpha \div \cos \phi$

Constant 2 = $\sin \alpha \tan \phi$

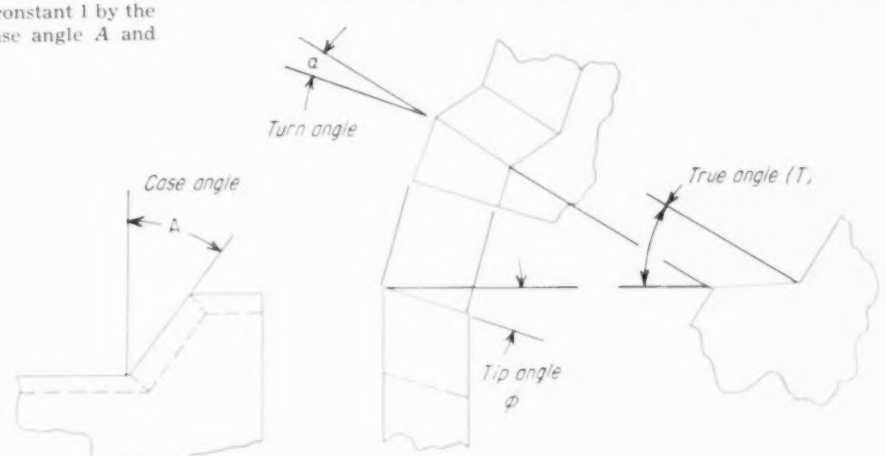
Example: Case angle A = 29°, tip and turn angles = 5°. What is the true angle T?

Tan 29° = 0.55431; constant 1 = 1.0000; constant 2 = 0.00762. Then tan T = 1 × 0.55431 + 0.00762 = 0.56193.

T = 29°20′.

CONSTANT TABLE

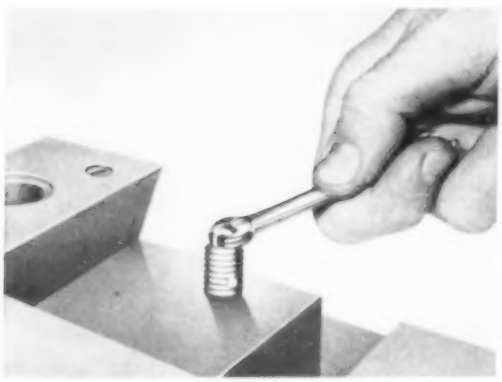
TIP ANGLES ϕ	CONSTANT	TURN ANGLES α 5°	10°	15°	20°	25°	30°	35°	40°	45°
5°	1	1.0000	0.9886	0.9696	0.9433	0.9098	0.8693	0.8223	0.7690	0.7098
	2	.00762	.01519	.02264	.02992	.03697	.04374	.05018	.05624	.06186
10°	1	1.0115	1.0000	0.9808	0.9542	0.9203	0.8794	0.8318	0.7779	0.7180
	2	.01537	.03062	.04563	.06031	.07452	.08816	.10114	.11334	.12468
15°	1	1.0313	1.0195	1.0000	0.9728	0.9383	0.8966	0.8480	0.7931	0.7320
	2	.02335	.04653	.06935	.09164	.11324	.13397	.15369	.17223	.18947
20°	1	1.0601	1.0480	1.0279	1.0000	0.9645	0.9216	0.8717	0.8152	0.7525
	2	.03172	.06320	.09420	.12448	.15382	.18198	.20876	.23395	.25736
25°	1	1.0992	1.0866	1.0658	1.0368	1.0000	0.9555	0.9038	0.8452	0.7802
	2	.04064	.08097	.12069	.15948	.19707	.23315	.26746	.29974	.32973
30°	1	1.1503	1.1372	1.1153	1.0851	1.0465	1.0000	0.9459	0.8845	0.8165
	2	.05032	.10025	.14943	.19746	.24400	.28867	.33115	.37111	.40825
35°	1	1.2161	1.2022	1.1792	1.14715	1.1064	1.0572	1.0000	0.9352	0.8632
	2	.06103	.12159	.18123	.23948	.29592	.35010	.40162	.45008	.49512
40°	1	1.3004	1.2856	1.2609	1.2267	1.1831	1.1305	1.0693	1.0000	0.9230
	2	.07313	.14571	.21717	.28699	.35462	.41955	.48129	.53936	.59333
45°	1	1.4088	1.3927	1.3660	1.3289	1.2817	1.2247	1.1584	1.0833	1.0000
	2	.08749	.17365	.25882	.34202	.42262	.5000	.57358	.64279	.70711



Practical Tooling Tips

No. 1 of a series

New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



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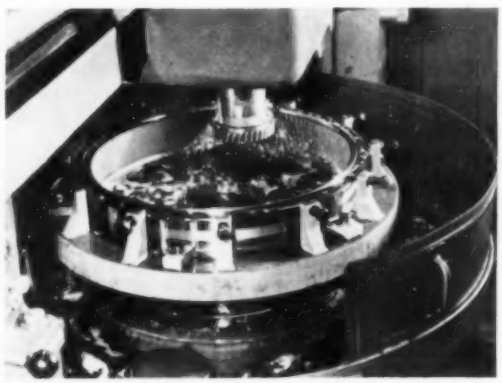

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FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

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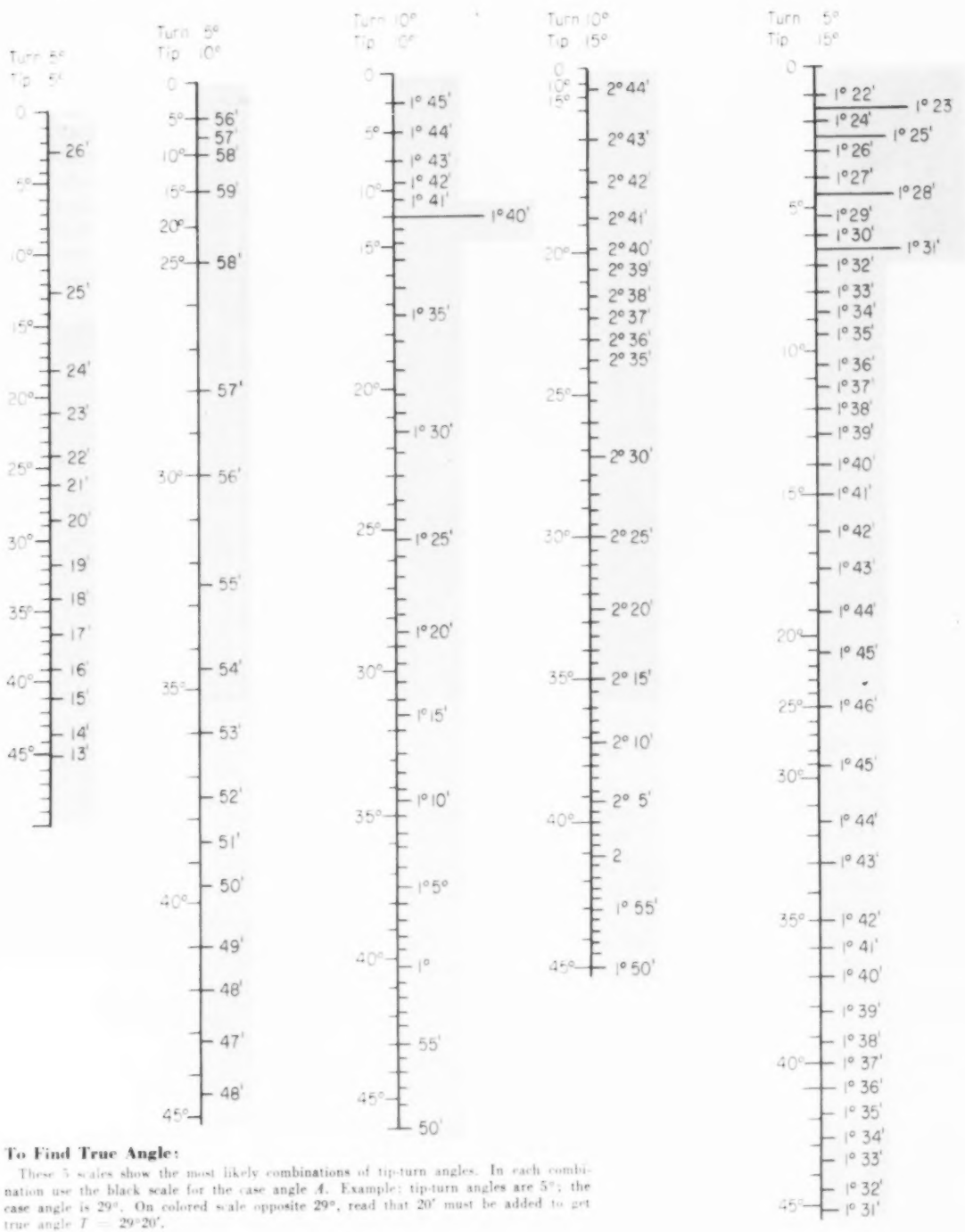
COMPOUND ANGLES—II



To Find True Angle:

These 5 scales show the most likely combinations of tip-turn angles. In each combination use the black scale for the case angle *A*. Example: tip-turn angles are 5°; the case angle is 29°. On colored scale opposite 29°, read that 20' must be added to get true angle $T = 29°20'$.

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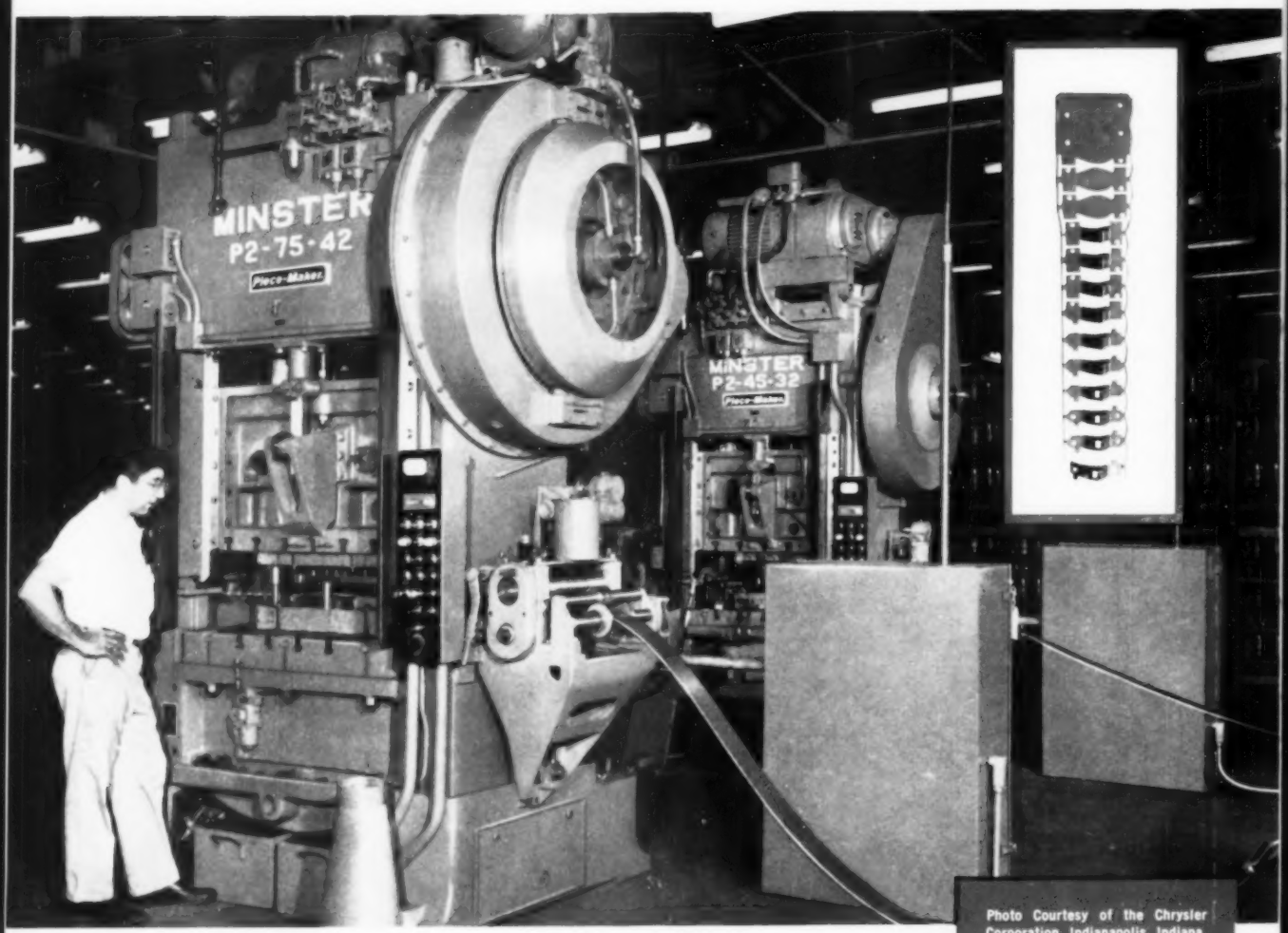

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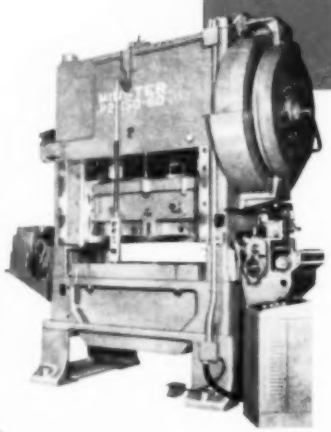

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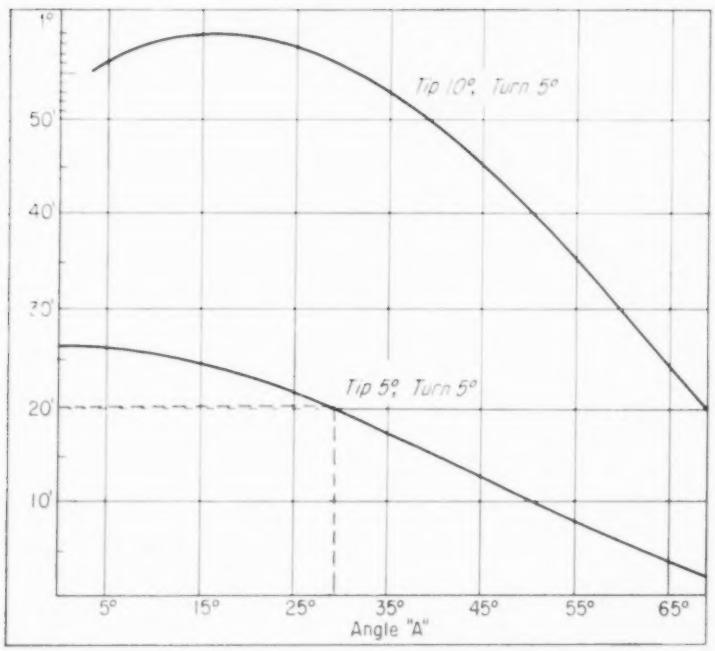
COMPOUND ANGLES—III

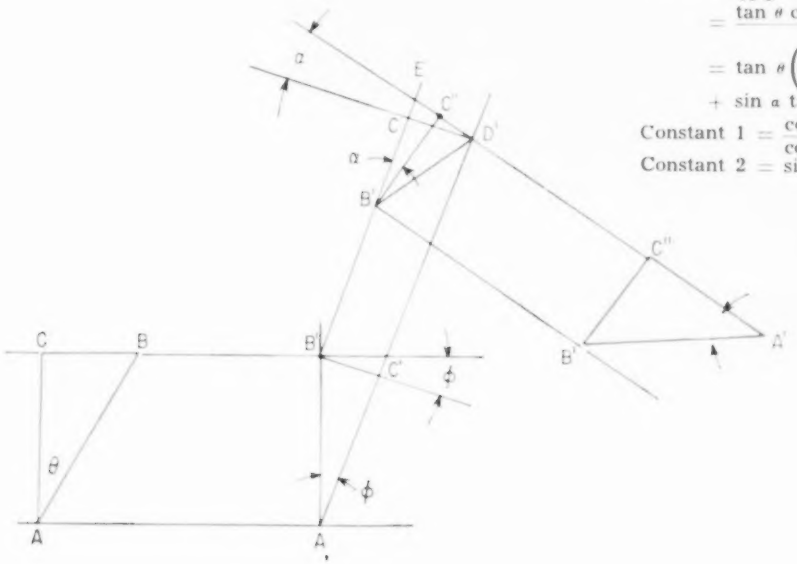


Graphical Solution of True Angle
This chart is laid out with two curves for tip-turn angle combinations. Example: case angle $A = 29°$, tip and turn angles are 5°. Follow construction lines to see that 20′ must be added to angle $A = 29°$, to get true angle $T = 29°20'$.

Proof

Given θ, α **and** ϕ
To Find T
Solution:

$$AC = 1 = AB'$$
$$CB = \tan\theta = B'C$$
$$B'C' = \sin\phi = CD$$
$$B'C'' = \cos\alpha\ (B'C + CE)$$
$$CE = \tan\alpha\ CD$$
$$B'C'' = (\tan\theta + \tan\alpha \sin\phi) \times \cos\alpha$$
$$= \tan\theta\cos\alpha + \frac{\sin\alpha}{\cos\alpha} \times \cos\alpha \sin\phi$$
$$= \tan\theta\cos\alpha + \sin\alpha\sin\phi$$
$$AC' = \cos\phi = A'C''$$
$$\tan T = \frac{B'C''}{A'C''}$$
$$= \frac{\tan\theta\cos\alpha + \sin\alpha\sin\phi}{\cos\phi}$$
$$= \tan\theta\left(\frac{\cos\alpha}{\cos\phi}\right) + \sin\alpha\tan\phi$$
$$\text{Constant 1} = \frac{\cos\alpha}{\cos\phi}$$
$$\text{Constant 2} = \sin\alpha\tan\phi$$



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Talking Shop...

Open Stacks

WHEN WE WERE STUDYING engineering the process of getting a book from the library was only slightly more complicated than drawing a tool from the average toolroom. You filled out a call slip, then waited while the book was found in the stacks and sent to you by pneumatic tube. The process took anywhere from 10 to 20 minutes and the desire to browse through a dozen books was pretty well stifled.

Last week we wandered through the new library at Rutgers. The full stacks were open to all students with convenient study areas distributed on each floor. "We lose a few books," said our guide, "but the time saved for the honest students makes it seem worthwhile."

We've since learned that the open-stack policy is followed at some other colleges, too. But we're still pondering the point that too many safeguards can be self-defeating. Like the newstands in Detroit that are unattended and profitable, we think you can count on the honesty and decency of most of your fellow men. Sometimes too much effort against theft makes a contest between the men and plant security.

In The Closet

LAST YEAR we devoted this entire page, on one occasion, to a topic we thought crucial to the survival of each of you in your careers. It was called "No Deadly Medicine, This." If you missed it, or if you remember it and would like a copy, check item No. 50 on the Readers Service Card inside the back cover and we'll send you a copy.

Continued Payoff

OCCASIONALLY WE REPORT a tale about the suggestion box. Once in a great while the tale is tragic, but most of them are happy. Here's one about James Vance, a physics instructor in Georgia. Four years ago he was a production engineer at Lockheed's Georgia Division and spent his spare time working on an improved blind rivet. His solution was so promising that he received a $50 suggestion award. Last month Lockheed received a patent on his idea, tracked him down in his physics lab and paid him another $100. From now on he will share in royalties received on the patent when an outside company is licensed to produce the rivet.

Wild Prediction

EVERY TWO WEEKS the pace of activity in our office rises to a frenzy as the fortnight's new developments are sifted to fit the most significant into Metalworking Report. In the midst of this activity last week one editor —who wishes to remain nameless— invented the following item to test the mettle of our selection system. We weeded it out, but in this day and age who knows? So we put our tongue in cheek and print it here:

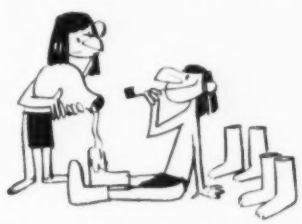
"At least 100% quicker assembly is forecast by the Rivet, Bolt, and Buttonhook Association as a result of a new rivet-assembly technique applied to standard rivets. The system requires no increase in equipment, but can double assembly speed."

"Key to the higher speed is a change of alternating-current cycling rate from 60 cycles to 120 cycles per second. This increases the speed of all motors by a factor of two, doubling mechanism speed, and doubling assembly rate.

"In some cases it may require extra investment to change motors in assembly shops to synchronous types; but the increase in assembly speed will otherwise cost no more except for a slight increase in electrical-power costs. Power factor is said to be unaffected by this method."

MEMOS

by BESS RITTER



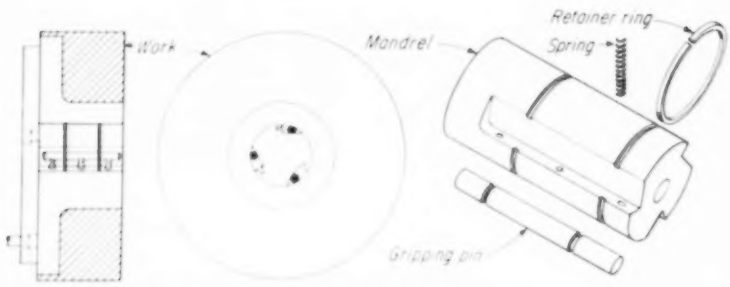
Although specialized machinery is used today for fashioning rubber footwear, the first shoes of this type were actually constructed on human feet: The Indians of the Amazon Valley in Brazil simply allowed the juice of their rubber plants to flow over their feet until they'd been covered with two or more separate coats. Each coat was allowed to dry completely in the sun. Finally, these hardened latex coatings were slipped off, and the bare feet were free to duplicate the whole process.

Boston received its first pair of such shoes in the year 1820, and they sold for $5 after being attractively decorated with a coating of gilt, and by 1830 there was such a demand for these "new" rubber shoes that approximately 30,000 were imported from the south.

One of the first motion picture shows was enjoyed in ancient Greece by means of an ingenious piece of machinery. This consisted of a pillar which was made to revolve on its own axis by means of a rope. Pictures were adhered in a horizontal row to the face of a column, and since they were in sequence when the column was spun around it blurred the individual pictures into a flow of continuous movement.

This, however, was not the first Grecian attempt at creating movies. An earlier method consisted of attaching drawings, arranged in sequence, to a series of poles. The audience was required to ride by them on horseback, and as they moved and watched, they'd get the impression that the pictures on the poles were moving as well.

Practical Ideas...



Tailor-Made Arbor Employs Quick-Acting Expansion Grip

When we recently got the job of machining large coupling flanges, and speed was of utmost importance, we had to limit ourselves to the least number of setups for each. After first boring the ID, and then facing one end of the large chunks of stock from which the parts were made, they were placed on an arbor and finished in a second operation.

Because of the weight of the material, (501 lbs before machining and 191 lbs finished) the arbor had to be sturdy as well as quick acting. The tool shown above fulfilled these requirements satisfactorily.

Loading the work onto the arbor is easy; the rotation of the spindle is simply reversed as the work is entered. After making sure that the finished face of the work is flush with the arbor back plate, the spindle is rotated clockwise to lock the piece. With a live center in the tailstock, adding support to the arbor, we are able to take ½-in. plunge cuts. These heavy cuts make a protective screen in front of the operator necessary.

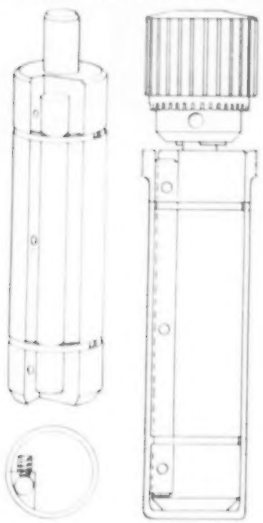
Unloading is as simple as loading. While the workpiece is held, spindle rotation is again reversed releasing the grip of the arbor. The work can then be slipped off.

Machining the arbor is carried out to close tolerances for the utmost in concentricity. The diameter should, at the most, have only a few thousandths clearance in the bore of the work; and the three 90° slots are milled to identical depths and widths. Three blind holes are drilled in one side of each slot for compression springs, and two circumferential flat grooves are cut for retainer rings.

Gripping pins are machined with flat grooves spaced identically to those in the arbor. The diameter of the pins will be determined by the depth of the slots in the arbor. The back plate, which is used to secure the arbor to the face plate, is a parallel disk with its center recessed to receive the arbor.

At left is another application of the same idea. Here a single-pin mandrel is used to internally grip work being polished in a drillpress.

David H McArel, tool designer, Havertown, Pa



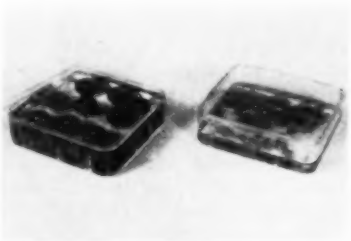
Nylon Inserts Remove Play

The flexibility of nylon can be put to good use in compensating for wear on machine ways. For example, where a slide has worn excessively in one section, because of constant use at that location, nylon inserts can take up side play in worn spots while they yield where the fit is better. The proper treatment for worn ways is, of course, to rescrape and refit them, but for a temporary satisfactory "fix" nylon will do a good job.

Most machine slides employ gibs which are adjusted by rows of setscrews. In making use of the nylon inserts, we remove these screws and replace them with screws having been drilled to receive nylon rods. The rods should fit loosely in the holes with only a slight projection outside the end of the screw.

Because nylon has a low friction coefficient, the same device can be used in other applications to eliminate play, or to create drag. The nylon can then be allowed direct contact with the moving part and should therefore protrude more.

James D Thackrey, Pasadena, Calif



Oil-Filled Plastic Boxes Protect Finished Parts

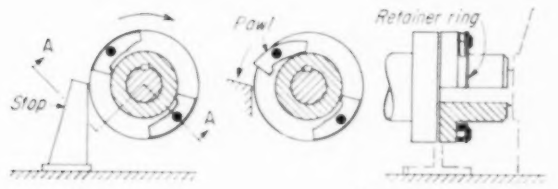
Small parts which have been ground and lapped to fine finishes are protected from rust and other surface damage, while awaiting assembly, by submerging them in clear lubricating oil. Handy containers for this purpose are shallow plastic boxes.

These boxes are easily obtainable from dime stores and are usually supplied with tightly fitting covers which will keep out dust and shop grit. The boxes are filled with enough oil to completely cover the parts.

This method of storage also provides an oil film on the parts to protect them from perspiration acids of the operator's fingers during assembly. The clear plastic simplifies visual identification for the purpose of inventory.

H J Gerber, Stillwater, Okla

Safety Device Prevents Accidental Conveyor Reversals



Section A-A rotated 45°

A section of our plant employs a number of conveyors, some of which are inclined. A near disaster that took place when one of the inclined conveyors had to be shut down while partially loaded, led us to design and incorporate the device shown.

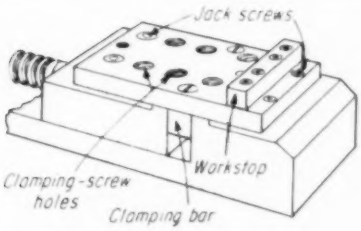
This simple, troublefree, locking mechanism prevents conveyor reversals caused by gravity pull of a load. The device consists of double pawls, which can be mounted on any standard flange coupling, and a stop secured to the base plate. Though the pawls may be mounted on either side of a reduction-gear box—when this unit is separate—they are more efficient on the motor coupling. The result is less back lash.

While the conveyor is under power, centrifugal force causes the pawls to retract, but as soon as motion is stopped, the top pawl swings to project its catch edge. Then, if a load creates a reverse motion, the pawl will hit the stop, preventing further slip back.

The pawls are cut from steel plate to the contours shown. A finger is provided to strike against the hub of the flange during rotation, and projection of the catch edge is increased by additional clearance on the inside at the other end of the pawl. The pivot holes are located so the major portion will be almost twice as heavy as the catch end.

Studs threaded into the flange are used in mounting the pawls. A full retainer ring, slipped over the hub and studs and locked with cotter pins, assures alignment and the necessary freedom of the pawls. The stop is a weldment, made up of steel plate, and bolted to the base.

Ahti Syrjänen, Valkeakoski, Finland



Vise Faceplate Saves Setup Time

While working on a vertical milling machine, an operator is sometimes required to remove the work-holding vise to make room for a piece which has to be fastened to the table. This means that time will be wasted, not only in taking the vise off, but also in putting it back on the table where it will again have to be bolted down and indicated.

A lot of these changeovers can be eliminated with the adaptation of a vise faceplate. The number of jobs that such a plate will handle is only limited by its work-holding capacity. Therefore, the plate should be as large as practical without going to extreme overhang. This leaves only the largest jobs to be strapped directly to the table.

After a ½-in. plate has been cut to the dimensions desired, a series of holes are drilled and tapped through it. Four of these holes, one near each corner, are used for jacking screws to level the plate after it has been gripped in the vise. The gripping block is doweled and secured from the top side of the plate with capscrews. A workstop bar is screwed and doweled to the top face of the plate. Both gripping block and workstop bar must be perfectly square with the edges of the plate.

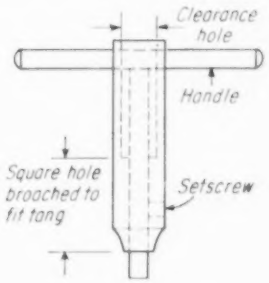
Following the careful drilling and reaming to place the blocks squarely across the plate, the three parts are hardenend and ground. The parts are then assembled and checked to see that the blocks have held their squareness and that the stop block is in line with the cross feed of the machine.

W Kreusser, Stamford, Conn

Chuck-Wrench Tang Is Renewable

The illustrated chuck wrench solves a problem found in many small shops. It provides a new tang whenever one is required, thereby saving the time and expense of making a new wrench or ordering one from an outside source.

To make a wrench do, long after it should have been replaced, does not constitute a saving. On the contrary, if it is used until it will no longer pull a chuck without skipping, the socket in the chuck suffers damage, which will eventually necessitate costly chuck overhaul.



Such stretching the life of a tool is not necessary when the wrench shown is employed. When the tang corners begin to show signs of wear, a setscrew is loosened, the tang is extended, and the worn section is ground away.

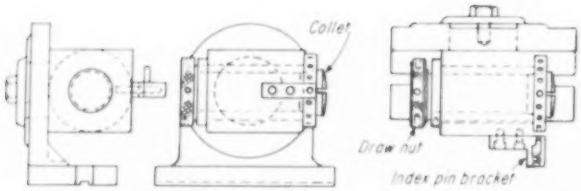
The wrench is machined in the usual way, except that instead of allowing material for a tang, a hole is drilled and broached through its center. Before broaching, a clearance hole is counterbored from the handle end to reduce the amount of metal the broach has to remove.

Two holes are then drilled; one diametrically through at the top for the handle, and one into the squared hole to clamp the tang. The tang is cut from C 1018 key stock, its length to be the full depth of the hole plus the extension, and hardened to a 1/32-in. deep case.

Buhl A Savage, foreman, Cogsdill Tool Prod Inc, Oak Park, Mich

Practical Ideas...

Workholder Uses Standard Collets



In production of cutters and punches requiring accurate flats, squares, hexagonal or octagonal shapes, the workholder shown will prove to be a great asset. This tool, with its 24 accurately-spaced indexing holes, simplifies the grinding and milling operations necessary for these and other shapes. In addition, the head can be set to produce a large variety of tapers.

With the exception of the collets, of which we have a complete set to give us a wide range of work-holding capacities, the parts are shop made. The cast iron angle bracket is made in such a way that when the head is mounted inside, it can swing enough to fill most requirements. And, when mounted on the boss of the outside face, the head can be set at any of 360°. A slot at each end of the base permits fixture to be secured to a machine table.

The head, bored to receive a collet adapter, is fitted with a disk to form a stud by which the head is mounted and rotated on the bracket. A tapped hole through the disk and into the head receives a capscrew, backed up by a heavy washer, for locking the head at desired angles.

After the adapter has been bored to suit the collets, the OD is turned to a smooth fit in the head bore. The back end of the adapter is threaded to take a retainer nut, while the front end is machined with a collar. In the periphery of this collar, 24 blind holes are drilled for indexing.

A small L-bracket is then made and secured to the side of the head to hold a spring-loaded index pin. To complete the necessary parts, a collet draw unit is made. This is threaded to suit the collets, outside knurled, and provided with four blind holes to fit a spanner wrench.

Milton L Johnson, Port Chester, NY

Shop-Made Impact Tester Does the Job

Where it is necessary to know the strength or breaking point of various material, an impact tester is the answer. And, if production warrants the expense, the purchase of a commercially-made tester is, naturally, the easiest solution.

However, when we were assigned the job of finding the right material for fabrications in plastic, we constructed the rig shown. Though limited in scope, it gave us uniform results throughout the tests.

With the exception of a ball-peen hammer, the rig is made entirely of $\frac{3}{4}$-in. thick plywood. A quadrant, affixed to an upright at one end of a base board, carries the hammer which has a hole drilled through its handle for a pivot bolt. A series of peg holes is drilled along the radial edge of the quadrant and marked according to impact received from each hole location.

In use, the material to be tested is placed on an anvil board affixed to the base. The hammer is then raised and a peg inserted in the hole marked with the specified degree of impact. When the peg is withdrawn, the hammer drops onto the material under test.

Harry J Miller, Sarasota, Fla

John L Elliot
Birmingham, Mich

$25 In addition to regular payment for his idea:

NON-PARALLEL WORK SUPPORTED ON MOLDED METALLIC PADS

in the March 23, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers in asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment
Materials and Parts

Electronically Controlled Die Shear Line Changes Length of Cut Without Stopping

McKaymatic Die Shear Line features an electronic control that changes the length of cut without stopping or slowing down the line. Length of cut is controlled by a surface measurement system consisting of a pulse generator on the exit pinch rolls and an electronic counter.

On the demonstration model the operator reads-in length of cut commands by pushbuttons, but automatic programming can be supplied in the form of standard data processing cards, punched tape, or a series of manually pre-set length and quantity selectors.

The die shear lines are built to handle coiled metal in any width and most thicknesses. Demonstration line includes a 35-ton under-drive four-column press with ac drive and pneumatic clutch and brake. Capacities of the demonstration line are 48 in. wide, maximum thickness of 10 gage. Initial designs obtain production speeds of about 200 fpm cutting length of 4 ft and over.

Strip damage is prevented by the synchronized traveling die. During a cutting cycle, the traveling die set accelerates to line speed, cuts, and returns on anti-friction bearings over hardened steel guide rails.

According to the manufacturer, the machine will produce high tonnage per hour production on variable-length operations with an accuracy equal to or better than competing lines.

McKay Machine Co, Youngstown, Ohio

MORE DATA? Circle 51, inside back cover

Metalworking Coolant Reported To Stop Rust, Resist Rancidity

Water-soluble metalworking coolant that does not hold dirt in suspension is reported to stop rust, resist rancidity, and reduce dematitis. Product is said to stay clean for weeks, even when used on cast iron.

Tradenamed Cold Stream, the coolant has a combination of anodic and passivating rust inhibitors to guard against both electrolytic corrosion and atmospheric moisture. It does not contain a bactericide and is neither a sodium nitrite coolant nor a soluable oil. Surface-active agents are used in the formula to reduce surface tension and bring the solution in close contact with the metal surfaces.

Cold stream is also said to absorb and transfer heat with top efficiency and to provide improved lubrication for highest feeds and speeds.

S C Johnson and Son, Inc, Racine, Wis

MORE DATA? Circle 52, inside back cover

High-Intensity Mercury-Arc Lamp Offers Improved Detail on Optical Comparators

Said to provide more than five times the intensity of the best filament light source available today, a new mercury-arc lamp developed by the Comparator Div of Jones & Lamson Machine Co, Springfield, Vt, offers greatly improved detail at higher magnifications on optical comparators. Designed for use with all 14-in.-dia and 30-in.-dia-screen optical comparators, the lamp can also be used on other optical instruments.

An extremely bright, extremely sharp (see cover) shadow image is produced by the high-intensity light source, even at magnifications as high as 270 times. Also, the stable mercury arc supplies steady, projected light having no flicker. In effect, this lamp gives, at 100 magnifications, a light intensity equivalent offered by the best other sources of light at 20 magnifications. It is a pleasant, cool, blue-white light at high magnifications and, if not filtered, a penetratingly bright light at magnifications of 10 to 20 times.

Packaged as a unit, the separate control element (power pack) measures 3 ft by 2½ ft by 1½ ft and is powered from a standard single-phase 115 volt outlet. The lamp housing attaches to the conventional light-source mounting on the comparator. A fan plus aerodynamic airflow design aircools the lamp housing. Standard mercury-arc lamps, as supplied by various manufacturers, can be used in the system. Safety precautions include: A specially designed lamphouse enclosure to contain and control lamp explosion plus interlocking switches to cut power and discharge capacitors when cover or power-supply door is opened.

Jones & Lamson Machine Co, Springfield, Vt

MORE DATA? Circle 53, inside back cover

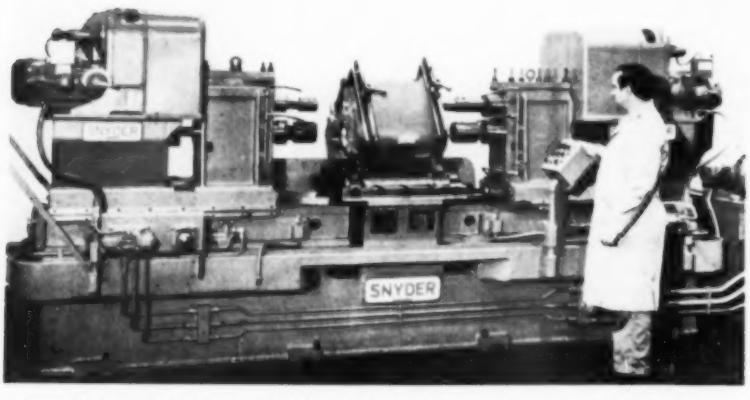
Multiple Wheel Grinder Produces Concentric Diameters to Close Tolerances

Type IWR that will grind two or more concentric diameters to extremely close tolerances on a production basis is available for completely automatic or semiautomatic operation. It is made in 10 and 14-in. swings with 30-in. length between centers. Wheel diameters are 36 in.; on the 14-in.-swing machine either 36 or 42-in. wheels are available. Parts such as crankshaft and camshaft line bearings, transmission shafts, and components of jet engines are ground on these machines to precision limits.

Machine incorporates Landis' new Microfeed wheel feed system (capable of duplicating its action for piece after piece) that will feed the grinding wheels in increments as small as 50 millionths of an inch. Feed automatically compensates for all variables which may be introduced by deflections of machine parts from grinding forces, variations due to minor temperature changes, changes in wheel characteristics due to grinding and dressing, and variations in feed rates caused by temperature changes by hydraulic oil.

Landis Tool Co, Waynesboro, Penna

MORE DATA? Circle 54, inside back cover



SIXTEEN DIFFERENT TRANSMISSION CASES having a total of eight machining variables are handled by this special double-end precision boring machine. Four holes are bored in each case at rates of 22 to 55 pieces per hour, depending on part length which ranges from 12⅞ to 21⅜ in.—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich*

MORE DATA? Circle 55, inside back cover

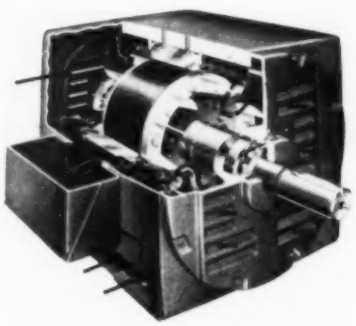
Ultrasonic Cleaner Line Uses Building Block Construction

Line of ultrasonic cleaners uses interchangeable tanks and generators in building block type construction to meet varying requirements of power and volume. Five tank sizes and six pre-set generators are used in the line of 13 cleaners.

Ceramic transducers are side-mounted on the tanks through a matrix, permitting addition or subtraction of transducers. The cleaner tank is fitted with a matched generator to satisfy the power needs dictated by the volume. The ceramic transducers, used for the first time in the new line, can operate at 350 F, 200 degrees higher than previous models.

Gulton Industries, Inc, 212 Durham Ave, Metuchen, NJ

MORE DATA? Circle 56, inside back cover



General Electric Redesigns Complete Line of AC Motors

Complete redesign of General Electric's random and form-wound ac motor line—ranging from 1 to 5000 hp—includes space-saving square styling, and a sealed silicone compound insulation system. Among the improvements claimed for the new line are adaptability to specific industry needs, faster installation, easier accessibility for maintenance, lower noise levels, and greater overall ruggedness.

Equipped with flat end shields, the new motors save from 22 to 45% of mounting space, depending on rating. The cast iron shields are lighter than old ones by 70% and can be handled by one man. Double-end ventilation is said to offer 75% more airflow.

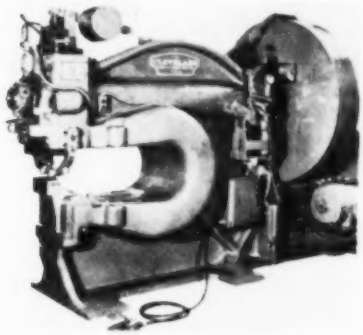
Supported silicone rubber insulation, called Polyseal, consists of silicone rubber-impregnated Dacron and glass tape wrapped around each coil in several layers. By using Polyseal, according to GE, open motors may now be considered for some se-

vere applications previously limited to totally enclosed motors.

Installation is simplified by an enlarged conduit box and by lifting lugs cast into the motor frame. Prewound cores permit considerable improvement of varnish impregnation. And the new anti-friction bearing has a special slinger which improves the ability to purge old grease during regreasing.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 57, inside back cover



Vertical Open Gap Machine Has Solenoid-Operated Clutch

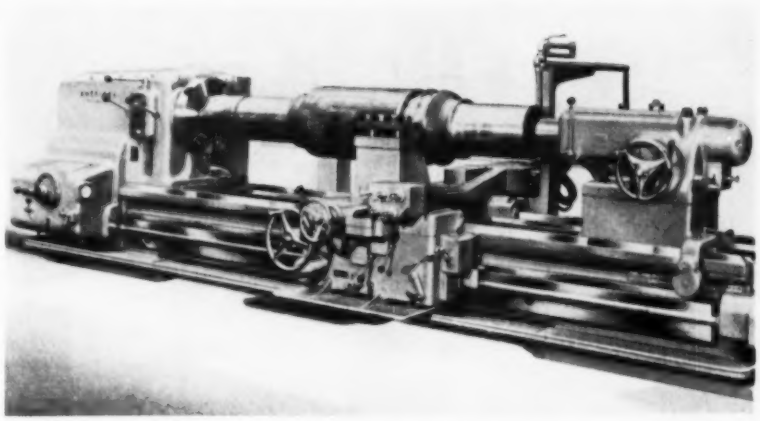
Type EF is designed for use in fabricating heavy steel plate and structural I-beams and girders. In addition to its punching attachment, it can also be equipped for flue hole punching, notching, and coping, as well as shearing angles, plates, and bars.

Solenoid-operated clutch automatically stops the machine at end of each operating cycle. Operator must release the pedal and then push it down again to start the new cycle. Machine can also be furnished with conventional automatic operation if this solenoid-produced semi-automatic action is not desired.

Unit has completely guarded gears and flywheel, and is equipped with an automatic lubrication system. Model has a punching pressure of 97-½ tons with sufficient capacity to punch a 1-¼-in. hole through steel 1 in. thick, enabling the operator to fabricate all standard and Bethlehem sections from 7-in. I-beams to 30-in. girders, including 14-in. columns punched in the flange and web. It can also shear ⅞-in. plate and will square shear angles 4 x 4 x ½ in. Machine can be furnished with throat depths from 12 to 60 in.

Cleveland Punch & Shear Works Co, 3919 St Clair Ave, Cleveland 14, Ohio

MORE DATA? Circle 58, inside back cover



Hydraulic Roll Duplicating Lathe Features Automatically Modulated Carriage Feed

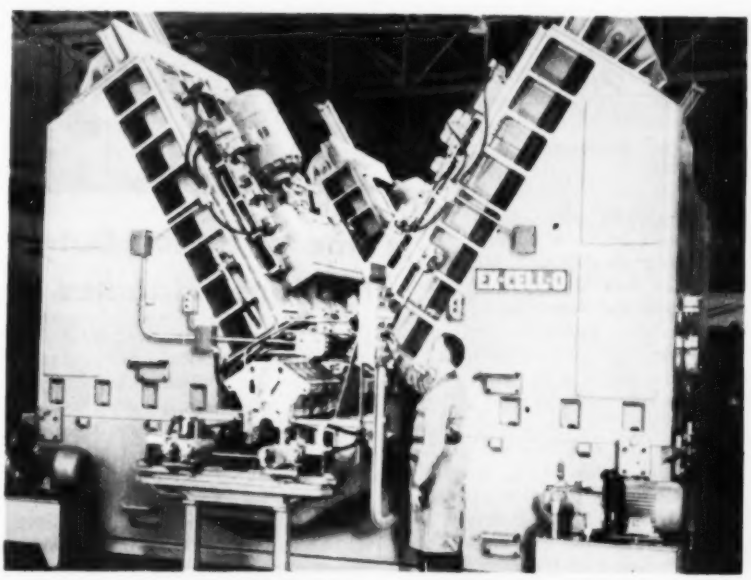
This hydraulic roll duplicating lathe, introduced by American Tool Works, is designed to contour machine mill shape rolls up to 33 in. dia. It is equipped with a new template controlled hydraulic duplicating mechanism and a single 90° tool slide which handles all roll tracing work.

Carriage feed is continuous, with the rate of feed automatically and steplessly modulated to meet the varying steepness of the contour. Feed rate ranges from zero on a 90° shoulder to the maximum pre-set by the operator for straight diameter. This stepless generation of the contours on the roll is said to make final finishing or touch-up operations unnecessary.

By switching a lever at the head end, the lathe can be instantly changed from a roll contouring or tracing lathe to a standard lathe. A new massive tailstock with oversized spindle has a built-in, ball bearing, revolving center. The lathe is available in several sizes.

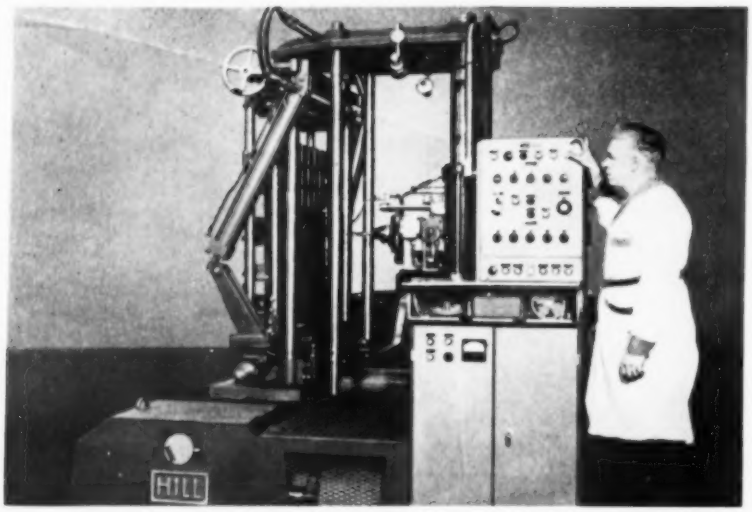
American Tool Works Co, Pearl St, Cincinnati 2, Ohio

MORE DATA? Circle 59, inside back cover



LARGEST CYLINDER BORING MACHINE ever built by Ex-Cell-O, 18 ft wide by 15 ft high, rough bores 6, 8, and 12-cylinder diesel engine blocks with minimum changeover time between the various sizes. Blocks are clamped in the fixture by three Rotac torque actuators—*Ex-Cell-O Corp, 945 E Sater St, Greenville, Ohio*

MORE DATA? Circle 60, inside back cover



Low-Cost Numerically-Controlled Machine Performs Drilling, Milling, or Jigboring

Low-cost numerically-controlled machine, of a single-spindle high-speed type, is designed to perform a variety of drilling, milling, or jigboring operations. Controlled by a General Electric Mark II universal numerical positioning control, the machine uses punched tape made from typewritten instructions to carry out a programmed spindle location and operation sequence.

According to the manufacturer, the low cost of the machine results from using a low-horsepower numerically-controlled positioning system in conjunction with a unique hydraulic control system. The hydraulic control system provides the majority of forces for moving the table horizontally and the spindle head vertically. This system uses counterbalanced hydraulic cylinders and requires no servo valves.

Traveling in a honed Meehanite sleeve, the 4-in. dia spindle is advanced, fed, and retracted by a pair of $3\frac{1}{4}$-in.-dia hydraulic cylinders that develop up to 16,000 lb thrust. It enables the machine to drill or gun-drill $\frac{3}{4}$-in.-dia holes in steel at feeds up to 30 ipm. Tape control provides linear spindle accuracy of ± 0.0005 in. Spindle, with 12-in. travel, is driven by a 15-hp motor operating through a variable-speed drive.

The hydraulically powered tilting worktable has a 25-ton capacity. Table and head travel for positioning is done at the rate of 84 rpm.

Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich

MORE DATA? Circle 61, inside back cover

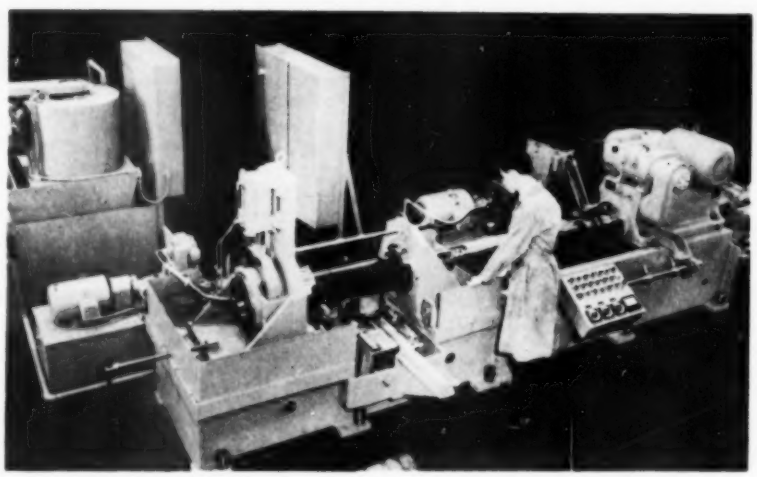
High Temperature Alloys Introduced by Fansteel

Two of a series of columbium base alloys are now commercially available. Fansteel 80 is a columbium-zirconium alloy with melting point of 4350 F; Fansteel 82 is a columbium-tantalum-zirconium alloy with melting point of 4550 F.

Both are easily fabricated at room temperature, either in the as-worked or annealed state. They are reported to have excellent weldability with ductile welds and little or no tendency to fracture in the heat affected zones. Ductile to brittle transition temperatures in the annealed state are well below room temperature. In air, Fansteel 82 has an ultimate tensile strength of approximately 30,000 psi at 2000 F. Fansteel 80, with comparable properties, has a higher strength-to-weight ratio.

Fansteel Metallurgical Corp, North Chicago, Ill

MORE DATA? Circle 62, inside back cover



Line of Heavy Duty Horizontal Honing Machines Handles Diameters to 36 in.

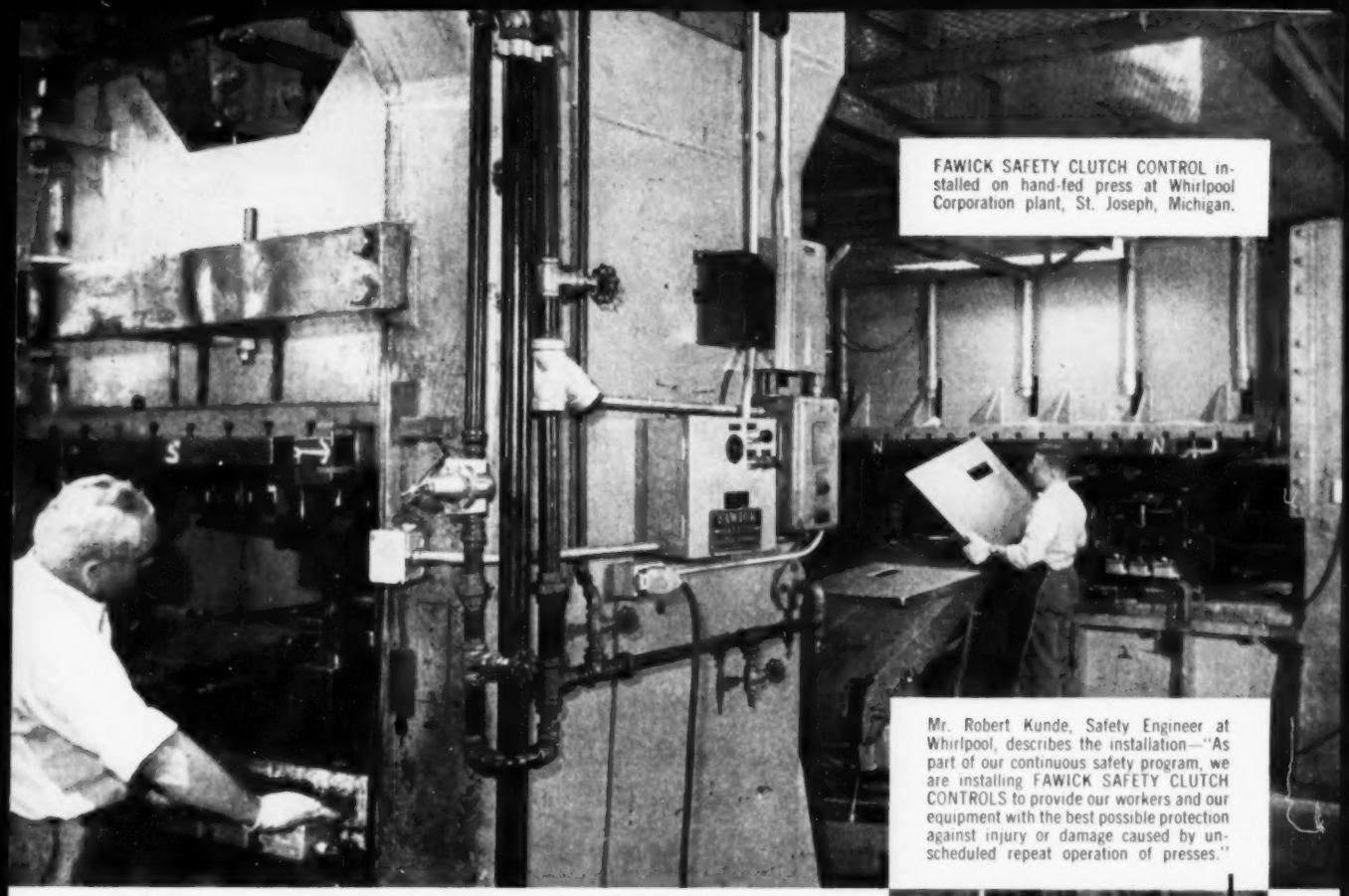
Line of heavy duty horizontal Microhoning machines are designed primarily for applications requiring heavy or rapid stock removal from large diameters and longer than average bores. They can be built to work almost any length of bore and diameters up to 36 in.

On one application a Model B-612 machine of this series is used to hone bores in oil well liners that are hardened to 64 Rockwell C . These bores range from $4\frac{1}{2}$ to $7\frac{3}{4}$ in. dia and up to 30 in. long. A special feed unit on this machine makes possible the removal of 1.3 cu in. of stock per minute from the liners. According to the manufacturer, this rate is twice that of previous honing capacities.

The Microhoning machine has two separate feed clutches—one for rapid approach, the other for finer feed. It has a 4-ft hydraulic head stroke, 8-speed transmission, variable delivery hydraulic pump and tank unit, and a mechanism that compensates for abrasive wear. Machine and fixture controls are interlocked for automatic operation.

Micromatic Hone Corp, 8100 Schoolcraft Ave, Detroit 38, Mich

MORE DATA? Circle 63, inside back cover



FAWICK SAFETY CLUTCH CONTROL installed on hand-fed press at Whirlpool Corporation plant, St. Joseph, Michigan.

Mr. Robert Kunde, Safety Engineer at Whirlpool, describes the installation—"As part of our continuous safety program, we are installing FAWICK SAFETY CLUTCH CONTROLS to provide our workers and our equipment with the best possible protection against injury or damage caused by unscheduled repeat operation of presses."

another Fawick First!

. . . the new "fail-safe" press and automation control

Press owners and operators alike are very enthusiastic about the new FAWICK Safety Clutch Controls (Andrus-Coon System). This outstanding development prevents "unscheduled" repeats in press operation, with a "fail-safe" system that eliminates possibility of component operation failure.

The FAWICK Safety Control utilizes a dual system, with two completely independent sets of controls and all systems and circuits so established, either before or during the operating cycle, that two complete and separate control systems are functioning at the time the "automatic stop" (at the top of the stroke) is required. The mathematical law of probability of simultaneous failure of two similar (or even dissimilar) devices in this system has been calculated conservatively at one (1) in 110,000,000,000 cycles. This great safety advancement is available for installation on new equipment or that being re-newed or overhauled.

For complete details on the FAWICK Safety Clutch Control call or write your nearest FAWICK representative or the Home Office, Cleveland, Ohio.

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON ROAD • CLEVELAND 11, OHIO
Fawick Canada, Ltd., 60 Front St., West, Toronto, Ont., Canada

FAWICK AIRFLEX

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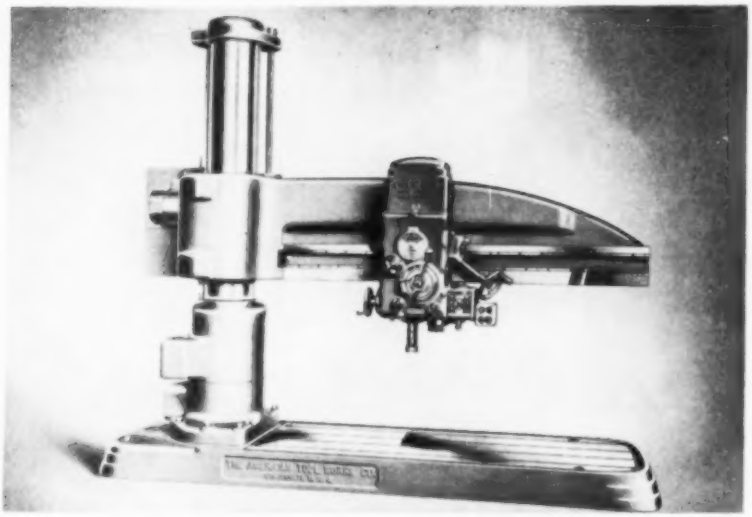
CIRCLE 257 READER SERVICE CARD



American Introduces Medium Range Radial Drill With Longer-Than-Usual Arm Reach

American's new radial drill, called the Maxi-Speed Hole Wizard, is designed for users who need a medium range of twist drill, boring tool and tap sizes.

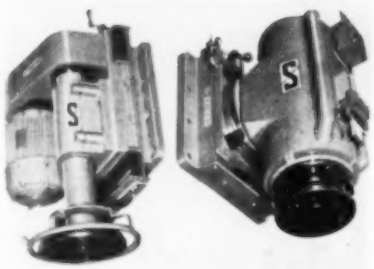
Available in column sizes of 13, 15, and 17 in., with arm lengths from 5 to 8 ft, the new radial has a frame made up of the same parts used on the company's heavy duty line of radial drills. The arm reach of the machine is one to two feet longer than on comparable drills, thus producing a design that incorporates a proportionately smaller machine in comparison to arm length.

Drilling capacity is 2½ in. in mild steel at 85 fpm and 0.014 in. feed per rev, and 3 in. in cast iron. At heavier feeds of 0.025 in. per rev, capacity is 1½ in. in mild steel. Using a new fine feed boring attachment which gives additional feeds as low as 0.001 in. per rev, the Maxi-Speed can finish bore a 3 in. dia hole to a depth of 3 in., with an accuracy of 0.0003 in. in both roundness and taper in cast iron.

Either 12 or 24 spindle speeds are available, depending upon the choice of a constant speed or two-speed motor. Motor, which is head mounted, may be 5 hp or 7½ hp. For critical facing operations, the two-speed drive motor provides a minimum spindle speed of 22.5 rpm. For small hole drilling, it provides a top speed of 2250 rpm.

American Tool Works Co, Pearl St, Cincinnati 2, Ohio

MORE DATA? Circle 64, inside back cover



Two Electrolytic Spindles Available From Standard

Spindle No. 2000RLY (left) is designed for a 600 amp dc power supply, and is equipped with a 5 hp, 1800 rpm ac motor and belted drive with speed change to satisfy 6 to 14-in. straight or cup grinding wheels.

Each backing plate for the cup wheel also involves the sprinkler-spider for introducing the salts solution at the perimter and internal recess of the cup wheel. The spindle assembly on the vertical feed provides for a 9-in. traverse parallel with the spindle.

Spindle No. 6028LY (right) is a direct driven ac motorized unit, 7½-hp, constant torque, with four speeds of 3600, 1800, 1200 and 600 rpm. The slip ring of this spindle is designed for 3000 amp power supply.

This unit is suitable for mounting circular adapter plates for cup wheels, but is illustrated with wheel holder to mount straight grinding wheels. A 360° swivel base is assembled between the motor base and the feed base or slide. Cup wheel sizes for this unit range from 6 to 18 in. dia, straight wheels from 14 to 20 in. dia.

Standard Electrical Tool Co, 2490 River Rd, Cincinnati 4, Ohio

MORE DATA? Circle 65, inside back cover

Lubricants Possess Great Acid, Heat, and Pressure Resistance

Almasol lubricants, an aluminum-magnesium-silicate compound, are claimed to possess great load carrying strength, provide complete resistance to all types of acid wear, and be able to retain these qualities without change up to temperatures of 1900 F.

Almosol products form micro-thin layers of natural lubricant between the fluid-film of oil and the metal surface. The first layer bonds itself to the metal surface and other layers slide horizontally across the bonded layer.

Five products in the line include bearing and chassis lubricant, enclosed gear lubricant, aircraft lubricant, and bearing and instrument lubricant. Price ranges from $.60 a pound for most applications up to $7.40 a pound for some jet aircraft applications.

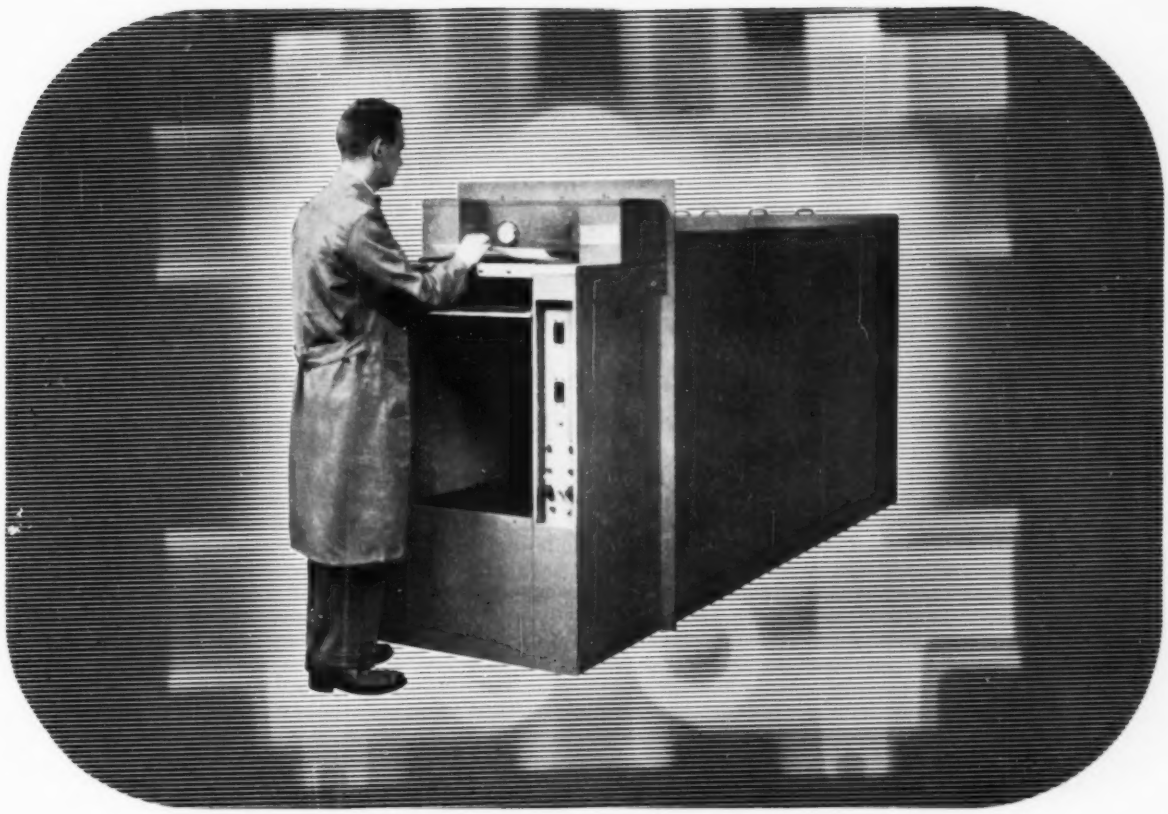
In one of the field tests, the lubricant was used in a wire drawing die. Up to 125,000 ft of wire was drawn before die replacement, compared with a normal expectancy of 15,000 to 20,000 ft.

Lubrication Engineers, Inc, 2709 Race Ave, Fort Worth, Texas

MORE DATA? Circle 66, inside back cover

METAL CUTTING BANDSAW and band filer has provision for mounting a blade butt welder. Metals handled include hard alloys and carbon steels —*Boice-Crane Co, 935 W Central Ave, Toledo 6, Ohio*

MORE DATA? Circle 67, inside back cover



13-minute industrial x-ray film processing

New Kodak Industrial X-Omat Processor can save you time and money

Kodak offers you automation in film processing—radiographs of uniform high quality, dry and ready to read in 13 minutes.

Film hangers are eliminated. Exposed films are merely removed from the film exposure holders and fed directly into the processor. Kodak Industrial X-ray Film, Type AA and Type M—sheet films or continuous lengths from 70mm to 17 inches wide—go through the system at 38 inches per minute. *And* only 22 inches of the unit's 10-foot 10-inch length need extend into the darkroom itself.

The Kodak X-Omat Processing System saves time and cuts costs. You'll want the complete story.

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Firm Name_____

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(City)_____ (State)_____

Kodak

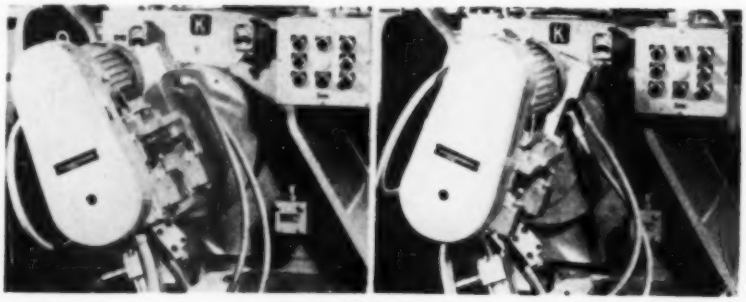
Spiralap Machine Mechanizes Hand-Lapping Operations

Spiralap line of flat lapping machines eliminates manual hand lapping while providing extreme precision on flat work surfaces. Manufacturer reports that any mechanic can productively generate lapping accuracy within one light band (0.0000116 in.) on this equipment.

Quality control is maintained through the ability of the machine to relap its own plates. Unit's components include a lapping plate with a spiral groove filled with abrasive compound; two (or more) adjustable work locating arms to effect rotation of the work by the lap; and two timers to control the work cycle and to total the use time of the lapping plates between conditionings. As the plate rotates, a steady supply of compound moves between the work and the plates. SPL-9A bench model which has a 9-in. plate is priced at $795. Several other designs are available, including floor models of larger capacity.

Micromatic Hone Corp, 8100 Schoolcraft Ave, Detroit 38, Mich

MORE DATA? Circle 68, inside back cover



Cross Transfer Machine Features Swiveling Drill Units, Lift-and-Carry Transfer System

Innovations on this Cross Transfermatic, built to process various sizes of aluminum or cast iron cylinder heads, include drill units that automatically swivel to chamfer two holes without re-orienting the part, and a lift-and-carry transfer system that eliminates scratching of precision locating surfaces.

Two single spindle quill-type drill units are used for the swiveling operation. Each unit, mounted on a revolving drum plate, chamfers one end of two oil gallery holes. After chamfering the first hole, the quill retracts and the unit is revolved by a hydraulic cylinder until the spindle is aligned with the centerline of the second hole. Adopted for economy reasons, this method is possible because it takes longer to drill the oil gallery holes at preceding stations than it does for one swivel unit to chamfer both holes.

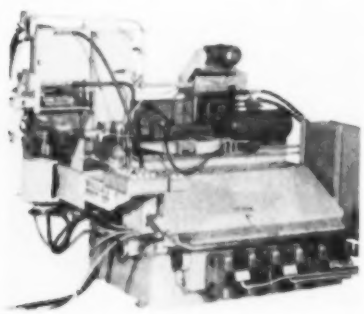
The Transfer-matic machines the ends of 2, 3, and 4 cylinder cast iron diesel engine heads at rates of 38 to 44 heads per hour at 100% efficiency. In addition to face milling water outlet pads, oil and fuel hole bosses on three planes, the machine drills, chamfers, and taps all oil fuel, and screw holes and air tests the part for casting density.

Features which facilitate later processing of aluminum heads, include an integral chip disposal system, a central coolant and filtration system, "woodpecker" drilling mechanisms, and changeable drive gears for increasing cutting speeds.

A new machine control system permits operation of the machine at partial or full capacity when processing a batch of heads.

Cross Co, PO Box 3835, Detroit 5, Mich

MORE DATA? Circle 69, inside back cover



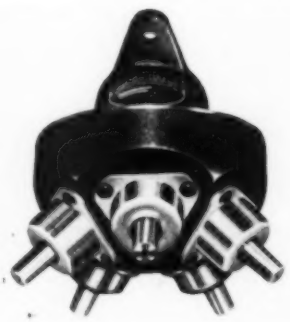
Wallace Tube Bender Performs All Operations Automatically

Automated machine feeds tubes into position, bends them, and removes bent product without attendance other than to keep the inlet conveyor or hopper supplying material. Two tubes can be processed during each operating cycle. Flat-back U's can be produced at the rate of 1800 bends per hr, or conventional return bends at 980 per hr.

Special finned elevator picks up programmed tube lengths from a hopper collector and indexes them into a pair of vertically stacked loading trays. Sequence-controlled hydraulic cylinders select the tubes from the trays and re-index them into the bending dies. Clamping dies advance and secure the tubes into the forming dies. Mandrels are automatically inserted into the ends of the tubes for support during bending. Bending dies are self-compensating and hydraulically actuated. A stripper mechanism removes the two tubes from the die.

Wallace Supplies Mfg Co, 1304 Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 70, inside back cover



5-POSITION TURRET HEAD, Quindrill, permits five different operations on one drillpress—drill, ream, countersink, counterbore, tap—without changing setups. Available in sizes to fit almost any drillpress, including 15 and 20-in. Deltas, for Morse taper and Jacob taper spindles—*Chicago Quadrill Co, 1846 Busse Highway, Des Plaines, Ill*

MORE DATA? Circle 71, inside back cover

NOW DIE BLOCKS and HOT WORK DIE STEELS made of VACUUM DEGASSED STEEL AT NO EXTRA COST TO YOU!

Another FINKL FIRST gives you these advantages:

REDUCED DOWNTIME

Finkl vacuum degassed steels result in die blocks and hot work die steels with greater ductility and toughness. This means size for size, and/or hardness for hardness, the degassed steel reduces the chances of breakage under severe operating conditions.

REDUCED DIE SINKING TIME

Finkl vacuum degassed steel die blocks and hot work die steels are cleaner, with about 50% fewer non-metallic inclusions, and consequently fewer tool regrinds are required. A higher lustre is possible in impressions if so desired.

POSITIVE DELIVERIES

Finkl vacuum degassed steel promotes high density centers in large die blocks, therefore reducing the possibility of a late shipment because of ultrasonic rejection.

DIE BLOCKS · FORGINGS · HOT WORK STEELS · ELECTRIC FURNACE STEELS

Finkl was first with die blocks fully water quenched. Finkl was first with deep hardening nickel-chrome-moly die blocks, the forerunner of the AISI 4300 Series. And now, we are pleased to add vacuum degassed steel die blocks and hot work die steels to our line of products—another Finkl First. They represent our policy of offering our customers every advantage to reduce costs and increase production.

For over 80 years we have produced quality products because we believe sincerely that the "best costs the least" in the long run. For impressions that last you can depend on Finkl.

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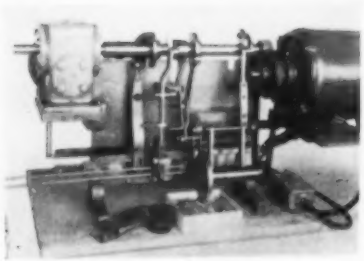


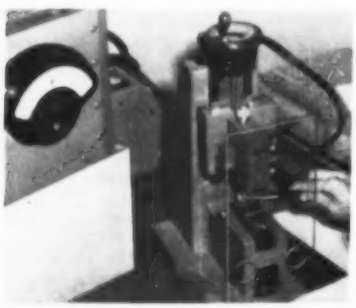
Machine Cuts Off 12,000 Pieces of Tubing Per Hour

Automatic machine cuts off small diameter round tubing at rates up to 12,000 pieces per hour. Basically designed for volume users of aluminum, copper, brass, or copper alloy tubing up to 7/16 in. OD, the machine is accurate to ±0.005 in. of piece length for cut-off lengths up to 2 in. This dual-feed machine can also handle tubing made of some plastics, such as polyvinyl chloride. One operator can service two or three machines.

Manufacturer offers the machines to prospective buyers on a guaranteed trial basis in their own shop. Price is $1850. Other special machines are available for even faster production of tubing cut-off to 2 in., for irregularly shaped tubing, for cut-off lengths over 2 in., or for round tubing up to ⅞ in. OD.

H and H Machine Co, Inc, Noble and Jackson Sts, Norristown, Penna

MORE DATA? Circle 72, inside back cover



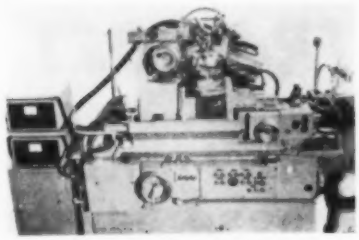
Gage Block Comparator Detects Variations of 0.000001 in.

Model 130 B-12 can accurately measure gage blocks as large as 4 in. Its electronic amplifier provides four magnifications, 2000:1, 6000:1, 20,000:1, and 60,000:1. Graduations are 0.000030, 0.000010, 0.000003, and 0.000001 in. respectively.

Precision-ground reference platen is fitted with two sets of three balls which provide an accurate three-point reference surface. Surface of this type helps to maintain a constant temperature relationship between master and workpiece. Parts are positioned quickly and better handling techniques, such as heat insulated tweezers, can be used. Balls are spaced in one set to take square blocks, the other set, rectangular.

Federal Products Corp, Providence, R I

MORE DATA? Circle 73, inside back cover



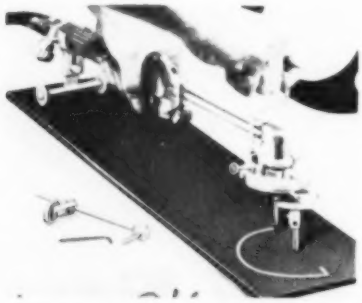
Grinder Designed to Achieve High ID-OD Concentricity

This Olivetti (Italian) internal-external type grinder is designed to achieve very close concentricity tolerances between ID and OD at high production rates. A prototype machine is now being used in a European automotive plant to grind synchromesh transmission gear shafts.

The standard machine has an external wheel, plunge, oscillating, automatically dressed, and an internal wheel, oscillating, automatically dressed, with automatic compensation for wheel wear every cycle during return stroke. Work is held in a specially designed self-aligning, hydraulically controlled collet fixture. Internal speeds range up to 150,000 rpm.

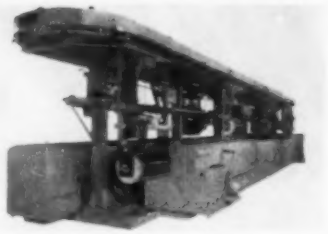
Olivetti Corp of America, Machine Tool Div, 42-35 Northern Blvd, LIC NY

MORE DATA? Circle 74, inside back cover



ACETYLENE TORCH ATTACHMENT, called Or-o-co, cuts precise circles from ½ to 12 in. dia, using a gear mechanism turned by a crank. It weighs 1 lb, costs $37.50—*Ideas Inc, 214 Ivinson Ave, Laramie, Wyo*

MORE DATA? Circle 75, inside back cover



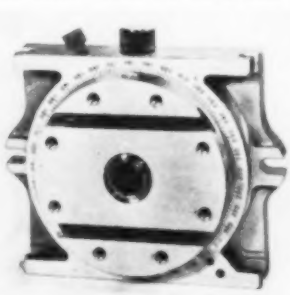
Automatic Processing Conveyor Does Several Jobs Simultaneously

Crown M-P (Multi-Purpose) conveyor, designed with new control systems, eliminates downtime for changeovers in plating, anodizing, painting, phosphatizing, and rubber dipping operations. Machines are built to individual plant requirements, but almost all of them include the following features:

Each carrier can be set for one of several cycles by automatic programming or manual setting on a control board. One machine can plate two or three different metals; work can be plated at four different thicknesses at the same time. Parts can vary from ¼ in. to 40 ft in length. Weight of work per station ranges from 10 to 3000 lbs. Rack and barrel work can be plated at two different voltages on one machine.

Crown Rheostat & Supply Co, 1965 Pratt Blvd, Elk Grove Village, Ill

MORE DATA? Circle 76, inside back cover

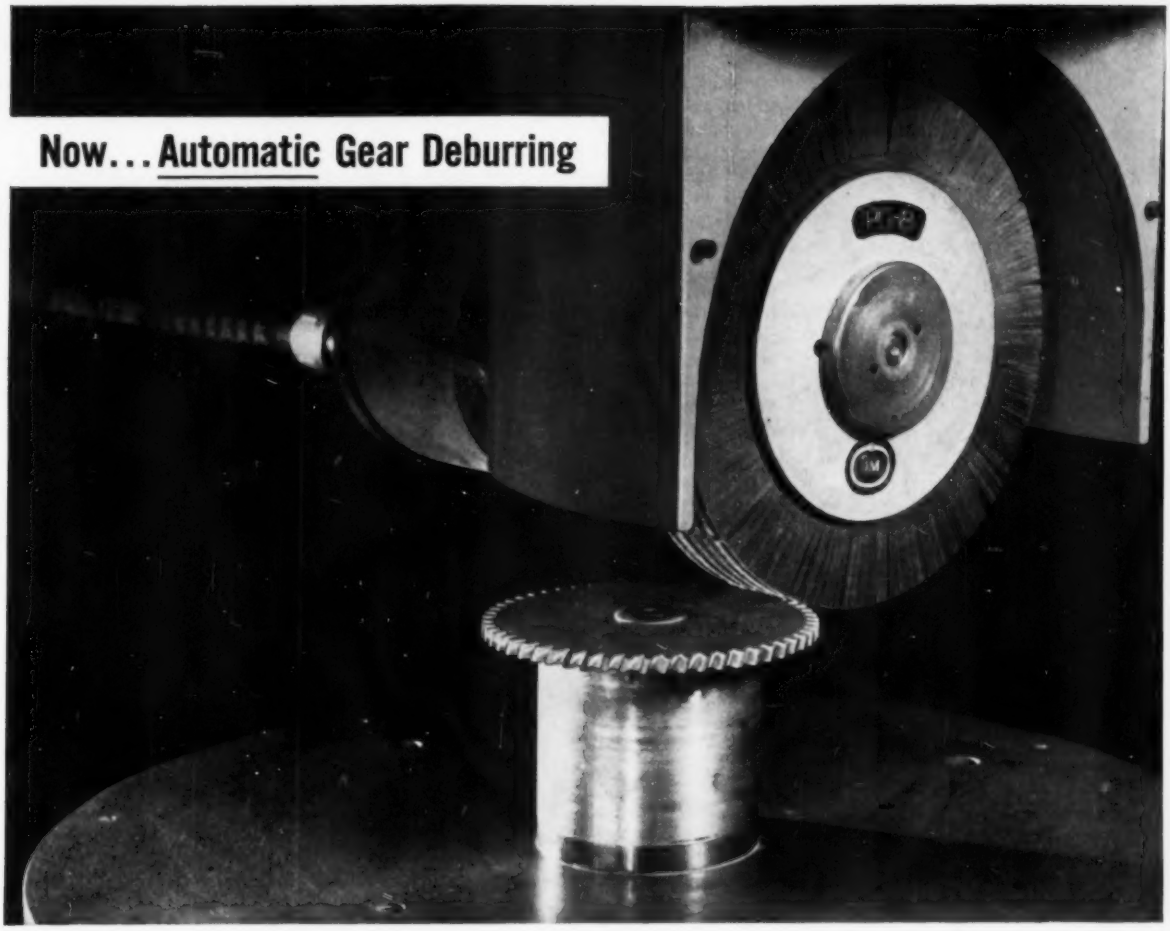


Small Index Table Provides 360 Positive Locking Positions

Table designed for inspecting, machining, measuring, or laying out small parts measures 6 in. long, 5 in. wide, 1⅝ in. high. It can be mounted on a machine tool or inspection bench in either horizontal or vertical position. Positive indexing feature eliminates need for careful visual settings usual in devices of this size. Position can be repeated within 2 minutes of arc.

Calectron, Inc, 2444 Beverly Rd, St Paul 4, Minn

MORE DATA? Circle 77, inside back cover



3M "PG" Wheels Cut Gear Deburring Costs up to 75% with New Barber-Colman Deburrer

Spur or helical gears and sprockets can be deburred automatically, rapidly and economically by this new Coated Abrasive method. Developed through joint effort between Barber-Colman Company and 3M Company, this method eliminates the costly hand operations—filing, grinding, wire-brushing—and expensively slow machine operations previously required for precision deburring.

The heart of the method is the versatile 3M "PG" Wheel. As shown, the abrasive leaves of the "PG" Wheel conform to the *exact* shape required to deburr either spur or helical gears. On-the-line tests of this 3M—Barber-Colman team have shown unit cost reductions of 75% and more on a variety of gears.

Write us today for complete information on this new method and machine and for 3M technical assistance on any grinding and finishing operation in your plant. See how the right abrasive can cut your costs and widen your profit margin. Address your request to 3M Company, Department AK-69, St. Paul 6, Minnesota. No obligation, of course.

"PG" Wheels are manufactured in U.S.A. by 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario

WE RECOMMEND
How to use coated abrasives to cut costs improve production, shown in the new 426 page book
COATED ABRASIVES
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3M Coated Abrasives

"PG" WHEELS

MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

Double Lap Flarer Introduced by Parker

Pneumatically operated machine for forming a double lap flare on the end of ferrous and non-ferrous tubing handles tubing of ⅛ through ½ in. OD with wall thicknesses of 0.028, 0.035, 0.042, and 0.049 in. Punches are available for either the JIC standard 37° flare or the automotive 45° flare.

Flaring assembly is supported by a floor-mounted steel cabinet. External air supply is introduced through a Hannifin Crown air filter, oil lubricator, and pressure regulator. A 3-position control lever simultaneously selects proper control valve position and operation to be performed by the power head. This unit positions and clamps the tubing, upsets the end, and double-lap-flares it. Model is 4 ft high, weighs 285 lbs; operating pressure is 70 to 120 psi.

Parker-Hannifin Corp, Fittings & Hose Div, 17325 Euclid Ave, Cleveland 12, Ohio

MORE DATA? Circle 78, inside back cover

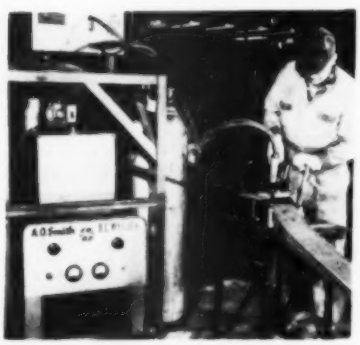
1200-lb Capacity Scrap Handler Developed for Tractor Shovels

Hydraulic scrap handling attachment, with a 1200-lb capacity and a 7-ft high dumping clearance, has been developed for the Yale Y-18 industrial tractor shovel.

High capacity of the claw-like unit permits handling large loads of lathe turnings, light gage blanking scraps, strips, and other objects that do not easily conform to normal bucket handling. Unit consists of: (1) seven rigid carrying forks welded to a 48-in. wide carriage, (2) four more widely spaced hydraulically controlled clamping forks which close against the carrying units to hold the load, (3) separately controlled hydraulic kick-off forks to sweep material from the carrying surface after dumping.

Yale Materials Handling Div, Yale and Towne Mfg Co, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

MORE DATA? Circle 79, inside back cover



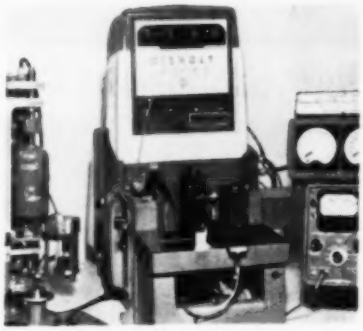
MIG Spot Welding Accomplished With Button Weld Attachment

Lowcost method of joining steel can, in many cases, replace or augment conventional resistance spot welding and/or riveting. Finished weld resembles a rivet or button head and is made possible through a button weld attachment for the company's CP-C-OManual welding package. It is particularly adaptable for welding of metals from 0.035 to 0.187 in. thick. It can also be used as a method of tacking together heavier gage sheet and plate, in place of manual arc tack welding. Additional application is in plug welding of heavier sheet metal where a hole is punched in the top sheet, a preferred method of joining stock in thicknesses over 3/16 in.

Basic CP-C-OManual unit consists of a constant-potential, 600-amp power source; wire drive that feeds an electrode at a high rate of speed; and a semi-automatic gun. It is suitable for lap, fillet, and butt welds on materials up to 1½ in. thick. High speed rates are made possible by the high current density inducted into the small diameter wire.

A O Smith Corp, Welding Products Div, Milwaukee, Wis

MORE DATA Circle 80, inside back cover



Gisholt Offers Line of Balancers For Miniature High Speed Parts

New line of high speed bench-type balancers is designed to handle miniature belt, air, or electrically self-driven parts or assemblies. Typical work includes armatures, aircraft and missile gyros, small spindles or turbines. Both horizontal and vertical models are available. Operation is simple, according to manufacturer, and does not require skilled personnel.

Unbalances causing work support movements greater than 0.000002 in., with the work rotating at any speed between 1000 and 3000 or between 4000 and 12,000 rpm, can be quickly and accurately measured and located. Standard equipment includes an amplifier, a direct reading amount of unbalance meter, and a strobe lamp assembly to indicate angle of unbalance. Supports for work from ½ to 8 oz or for work from 8 oz to 10 lbs are furnished.

Gisholt Machine Co, 1245 E Washington Ave, Madison 10, Wis

MORE DATA? Circle 81, inside back cover

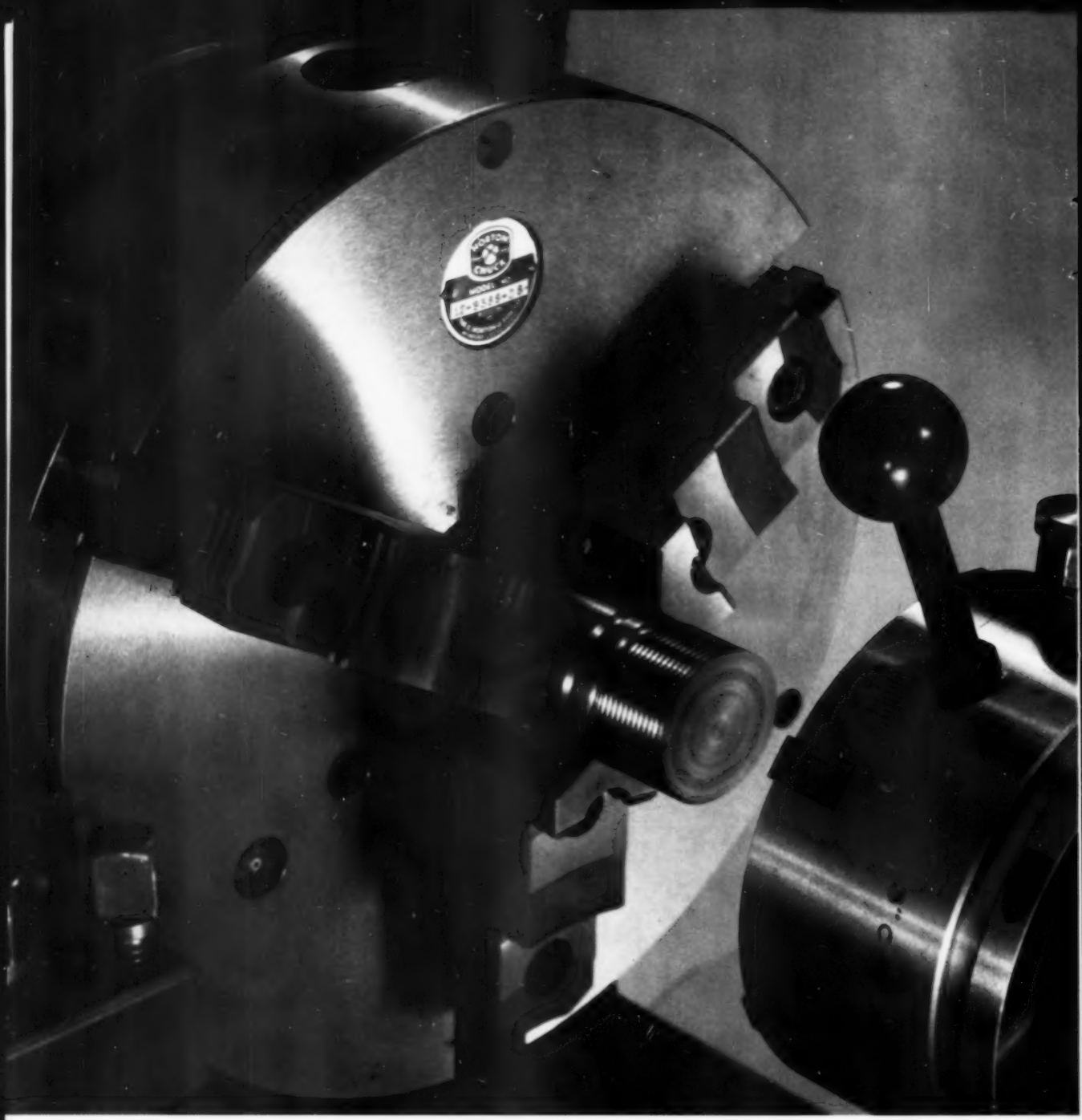
MINIATURE DRILL four times the thickness of a human hair has a diameter of 0.0135 in. for precision drilling copper, aluminum and plastics. It is made of solid cemented carbide—*Super Tool Co, Div of Van Norman Industries, Detroit, Mich*

MORE DATA? Circle 82, inside back cover

Variety is the price of "Life" No single type of drill will give the longest wearlife under all operating conditions. One style is best for mild steels, another for plastics, another for tough stringy metals and so on. So it is wise to choose the particular type drill that will give longest wear-life and best results on each of your drilling jobs.

Besides the Jobbers Length drills shown here, GREENFIELD-AMPCO Drill Catalog No. 58 lists dozens of other styles...and lots of application information, too. WRITE FOR A COPY TODAY.

GREENFIELD TAP & DIE GREENFIELD, MASS.



CLASS 3 THREADS WITH HORTON CHUCK!

What do we mean, talking about chucks and class 3 threads in the same breath? Just this: unless the work is held concentrically and runs true, that die head which is the best there is for the job (Geometric, of course) cannot compensate for excessive "run out" in the chuck.

That's why you need precision chucks, for precision threading.

Running class three threads? Better check your chucks, "Chuck" out worn out chucks, and, replace them with new HORTONS.

GEOMETRIC-HORTON, NEW HAVEN 15, CONNECTICUT

Pressure Foot Guide Saves Tools In Small Hole Drilling Jobs

Turret carried pressure foot drill guide is designed to add strength and rigidity to small drills used on the Burgmaster 6 and 8-spindle turret drill. Work is held down with spring tension which eliminates vibration and chatter. Drills are gripped shorter, reducing torsional twist and chattering.

Tools illustrated are mounted on a Burgmaster 2 BHT automatic tape controlled turret drill used for drilling printed circuit boards. Pressure foot guides assist in holding the ±0.002 or better locations with 0.029 and 0.052-in.-dia drills. No center drills are used or required. Drills from No. 80 to ¼ in. can be used in the guide for either hand or automatic applications.

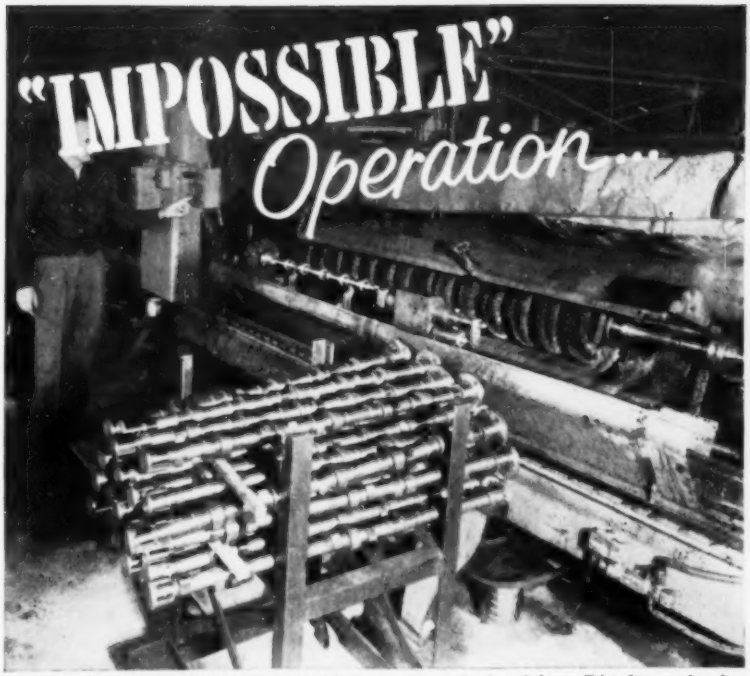
Burg Tool Mfg Co, Gardena, Calif

MORE DATA? Circle 83, inside back cover

High-Spiral Tap Designed for Stringy, High Temperature Alloys

Extended life, greater accuracy, and accelerated chip removal is claimed for the Hy-Spiral tap featuring a 52° spiral. The high spiral together with the 10 to 12° face hook and 2 to 2½ thread chamfer produce smooth accurate threads in difficult-to-machine materials such as stainless and boron steels, Monel, Hastelloy B, Inconel X, annealed SAE-1018 and C-1117.

Taps are said to be especially suited for tapping deep blind holes in aluminum and zinc die castings. Priced the same as standard spiral



POWER BRUSH CAMSHAFT FINISHING SETUP *was designed and built by Universal Camshaft Co., Muskegon Heights, Michigan. It incorporates lathe bed, air cylinder, 50 hp motor and a gang-unit of 14 Osborn Disc-Center® brushes. Operation deburrs cams and cleans plating chips from steel shafts automatically.*

UNTIL OSBORN POWER BRUSHING tackled this camshaft finishing job

This manufacturer had been finishing steel camshafts by a slow, costly off-hand method that resulted in pitted shafts and inconsistent deburring . . . high scrap loss. It looked like an "impossible" operation to improve.

But, today—using this ingenious power brushing method developed by the manufacturer's engineers and an Osborn field specialist—the job is done rapidly, economically with extremely high quality output.

An operator simply loads the steel shaft into a fixture. The Osborn Disc-Center® Brush unit drops against the work at pre-set pressure and time cycle . . . also reciprocates back and forth along the shaft. This action allows deburring cams of various type steel shafts *without* re-spacing the brushing unit. Plating chips are thoroughly cleaned from the main shaft at the same time.

With modern Osborn Power Brushing—this "impossible" job became a high-output, low-cost, quality-controlled operation.

An **O**sborn **B**rushing **A**nalysis—made in your plant at no obligation—can pinpoint new savings and better finishing methods for you, too. Write us for details. *The Osborn Manufacturing Company, Dept. C-84, Cleveland 14, Ohio.*

Osborn Brushes

POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING METHODS
BRUSHING MACHINES • FOUNDRY PRODUCTION MACHINERY

CIRCLE 263 READER SERVICE CARD

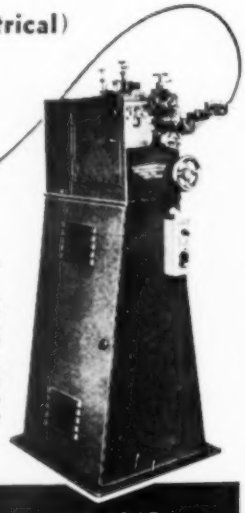
THE MOST COMPLETE LINE OF SPRING MAKING MACHINERY . . .

DESIGNED AND BUILT FOR THE METAL WORKING INDUSTRY

Sleeper & Hartley produce a complete line of spring-making machinery serving the basic metal working industries:

- Fabricated Metal Products
- Instruments
- Ordnance
- Furniture and Fixtures
- Transportation Equipment
- Electrical Machinery
- Machinery (except electrical)
- Miscellaneous Products

Quality and dependable service during 47 years of Sleeper & Hartley production have given the customer satisfaction for which we constantly strive.



No. 0 UNIVERSAL SPRING COILER, ESCAPEMENT TYPE. Series 720 — 73" Model.
This newest, versatile machine in the exclusive S&H escapement line incorporates the most advanced design engineering in the field, to give greater wire feed range and high speed production. Its many features include extremely accurate wire feed and controls for fine precision adjustment. Inertia is minimized since the only thing that starts and stops with this type feed mechanism is the wire itself.

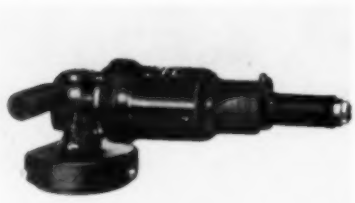
Write for latest information . . .

SLEEPER & HARTLEY, INC., BOX 1249, WORCESTER 1, MASS., U.S.A.

taps, the Hy-Spiral line is available in all standard sizes, including NC and NF pitches in machine screw sizes from 3 to 12, and fractional sizes from ¼ to ½ in. in increments of 1/16 in.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 84, inside back cover



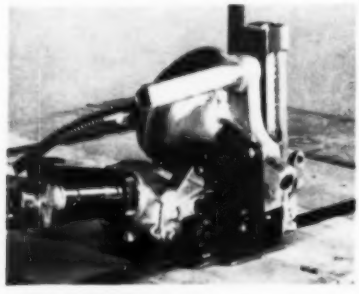
Heavy-Duty Electric Grinder Offered in Lighter Model

CP-550 Hicycle grinder, 30% lighter than its predecessor, is rated at 8-in. wheel capacity, has a speed sag under load of only 15%.

Motor is a squirrel cage induction type operated on a 180-c 3-phase 220-v current converted from available electrical supply by a frequency changer. In addition to the conventional intake ports, tool's design includes two new air channels which minimize hot spots. This Tri-Flow cooling system is reported to keep the rear rotor bearing 30% cooler than that of any other conventional grinder. Motor, gear case, and switch handle are magnesium castings.

Chicago Pneumatic Tool Co, 6 E 44th St, New York 17, NY

MORE DATA? Circle 85, inside back cover.



Steel Strapping Tool Is Fully Powered

Model A4 pneumatic Steelstrapper can be used in any position to apply either vertical or horizontal straps. Each strap is power applied to the same predetermined tension by means of a throttle on the handle. Another control on the handle produces a perfect sealed joint and

The PERFORMANCE is in the DESIGN

Norgren Pressure Regulators

for air and non-corrosive gases

- **Improve equipment performance**
- **Reduce compressed air costs**
- **Cut maintenance costs**

Norgren Pressure Regulators: 1. Reduce line pressure to the desired working pressure; 2. Provide the most efficient operation of connected equipment; 3. Maintain the established pressure even with widely fluctuating line pressure and rapidly varying flow.—***Results:*** Better equipment performance. Longer equipment life. Lower maintenance and compressed air costs.

Highly Accurate Pressure Regulation over a wide operating range. Outstanding performance is the result of these design features: 1. Balanced valve; 2. Large effective diaphragm area; 3. Improved baffle and siphon tube; 4. Large passages; 5. Large valve openings.

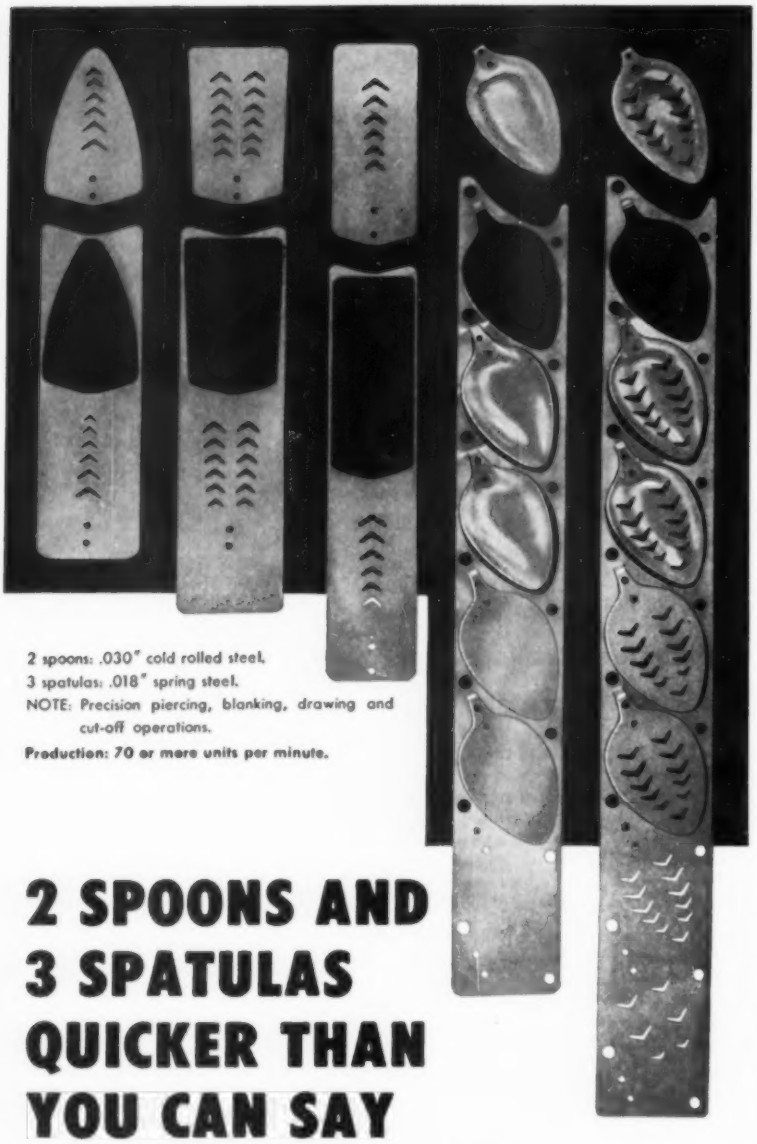
Also Norgren regulators for water, oil, other liquids and steam.

For complete information, call your nearby Norgren Representative listed in your telephone directory—or WRITE FACTORY FOR DESCRIPTIVE LITERATURE.

If it's Norgren...It's Dependable.

C. A. NORGREN CO.

3436 SO. ELATI STREET • ENGLEWOOD, COLORADO



2 spoons: .030" cold rolled steel.
3 spatulas: .018" spring steel.
NOTE: Precision piercing, blanking, drawing and cut-off operations.
Production: 70 or more units per minute.

2 SPOONS AND 3 SPATULAS QUICKER THAN YOU CAN SAY "FLAPJACK!"

Precision mass production of mixing spoons and spatulas—modern designs for modern homemakers—products of B. Jahn "Production Proved" Progressive Dies.

One of America's foremost kitchen tool manufacturers entrusted these five dies to B. Jahn because "nothing is too good for their customers." The result, dependable trouble-free tooling, a superior product, exceptional production speed and economy.

If your product is mass produced...

If "nothing is too good for your customers"...

If dependable production and competitive economy is desirable...

B. Jahn is your source for production speed, economy and tooling ingenuity.

Send for colorful "Case History" Brochure

B. Jahn

THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

cuts the strap flush with the seal. When job is completed operator raises the handle and strips tool to the left. Strap end is held in tool and unit is ready for next application.

Models are available for use with ½, ⅝, and ¾-in. strapping. Each will apply straps ranging in gage from 0.015 to 0.023 in.

Acme Steel Co, 135th St & Perry Ave, Chicago 27, Ill

MORE DATA? Circle 86, inside back cover

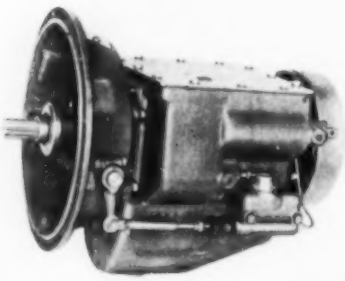
Pneumatic 4-in. Grinder Line Offers Choice of Three Speeds

The 902 Series of portable pneumatic grinders consists of 4-in. heavy duty horizontal grinders, wire brushing machines, and horizontal buffers. Grinders and brushing machine offer a choice of three speeds—12,000, 9000 or 7200 rpm.

Horizontal buffers, which have a 1-in. longer spindle than the other machines in the line, are available in 12,000 or 9000 rpm models. All machines in the 902 series are available with straight, lever, or grip type handles.

Thomas C Wilson, Inc, LIC 1, NY

MORE DATA? Circle 87, inside back cover



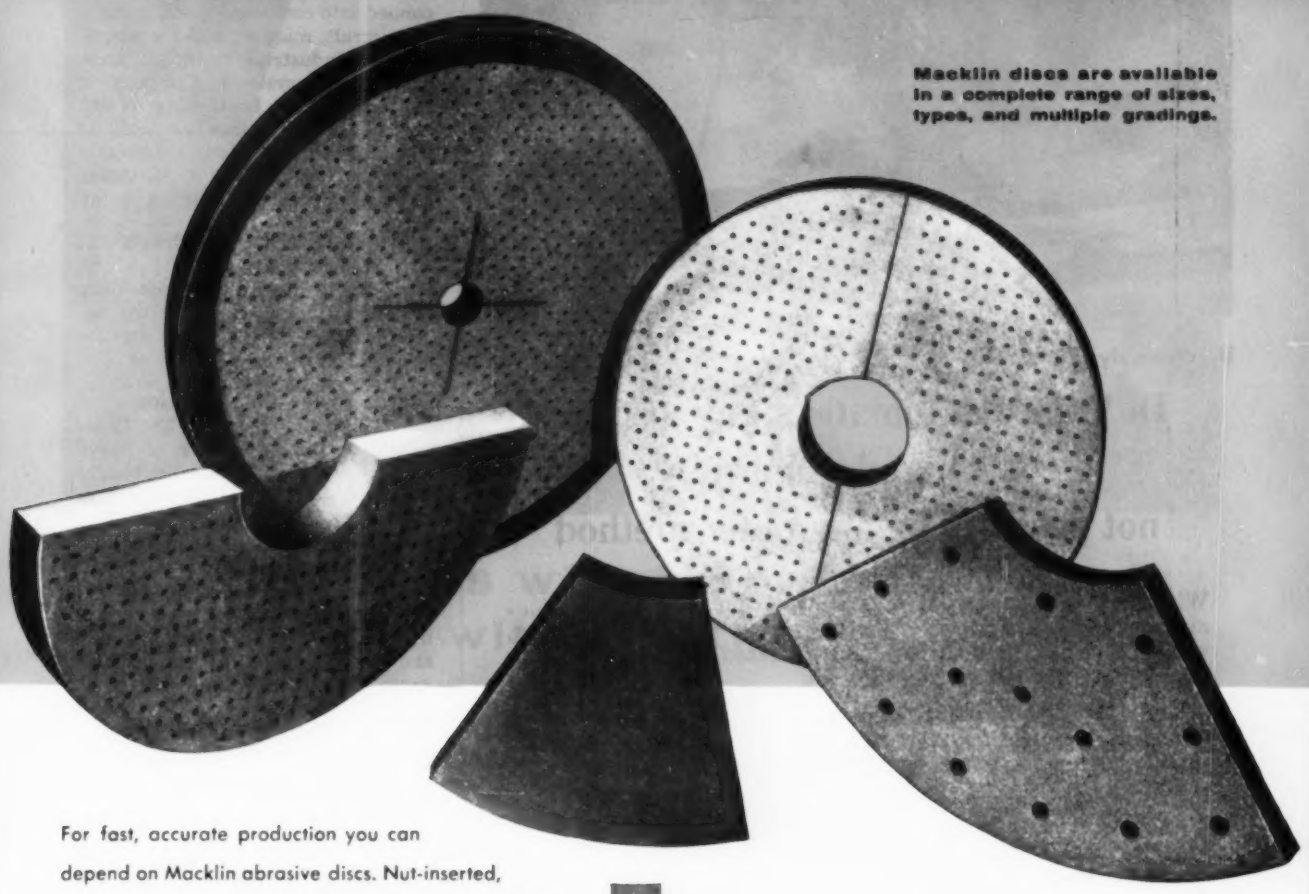
INDUSTRIAL TRANSMISSION is offered with four speeds, gear ratios to specification, max reduction of 9.4:1. It may be supplied with an auxiliary box to provide eight speeds. Capacity is 30 hp at 1800 rpm and 100 lb-ft of torque—*Western Mfg Co, 3400 Scotten Ave, Detroit 10, Mich*

MORE DATA? Circle 88, inside back cover

whatever your
disc grinding job.....

MACKLIN

has a money saving answer!



Macklin discs are available in a complete range of sizes, types, and multiple gradings.

For fast, accurate production you can depend on Macklin abrasive discs. Nut-inserted, bolt inserted, or plate mounted, each is custom built to your exact job requirements for standard disc grinding or vertical surface grinding.

Exactly matched, and uniform throughout, Macklin discs require less dressing, give greater stock removal and longer wheel life. *See for yourself* how Macklin discs cut free and clean; mount secure and flat. Consult your Macklin Sales Engineer or your nearest Macklin distributor. You'll find it's a money saving move!

GRINDING WHEELS

MACKLIN company

DEPT. 63, JACKSON, MICH.

CYLINDRICAL GRINDING WHEELS • CENTERLESS GRINDING WHEELS • TOOL ROOM WHEELS • WIREBOUND CYLINDER WHEELS • FOUNDRY WHEELS • SEGMENTED WHEELS • CUT-OFF WHEELS

CIRCLE 267 READER SERVICE CARD

If you apply fluids...

DeVilbiss automatic spray assures control and uniformity not possible by any other method

Whether you're finish-coating products of any size or shape . . . applying adhesives, lubricants, glazes . . . or marking, stenciling, surface treating . . . it's time you investigated the DeVilbiss automatic spray method for your process.

With DeVilbiss automatic spray guns, you eliminate coating variations common to other methods; material use is constant; production rates are fast and uniform; and costs substantially reduced.

What's more, you can know in advance, without charge or obligation, the exact economies of automatic spray. We will simulate your operation in our fully equipped DeVilbiss research laboratory. Your supervisors are invited to be there. The results are passed along to you. Why not contact your nearest DeVilbiss representative, or write us in Toledo for all the facts.

THE DEVILBISS COMPANY
Toledo 1, Ohio
Barrie, Ontario • London, England
São Paulo, Brazil
Branch Offices in Principal Cities

FOR BETTER SERVICE, BUY
DEVILBISS

OVENS • DUST COLLECTORS • INDUSTRIAL POWER WASHERS • FLOW & DIP COATERS • SPRAY BOOTHS
AIR COMPRESSORS • SPRAY EQUIPMENT • HOSE & CONNECTIONS • MIST-COOLANT UNITS

FIELD REPORT...

Sundstrand Takes New Name

Name of Sundstrand Machine Tool Co has been officially changed to Sundstrand Corporation. The Rockford, Ill, firm's non-machine tool operations have been expanded to the point where the old corporate name no longer accurately reflects the diversification of the company's business, according to President Bruce F Olson. Sundstrand has recently entered the packaging machinery field with a line of machines for automatic packaging of hard goods, liquids, and powders. It's also expanded into components and systems for aircraft, missiles, and rockets, as well as industrial hydraulic components and systems. Company is at the same time broadening its line of standard machines as well as special machinery, and is currently building an addition to its Belvidere machine tool manufacturing plant.

$41 Million in Navy Contracts . . .

. . . has gone to Bendix Products Division of Bendix Aviation Corp at Mishawaka, Ind. Orders are involved with the Talos missile for cruisers.

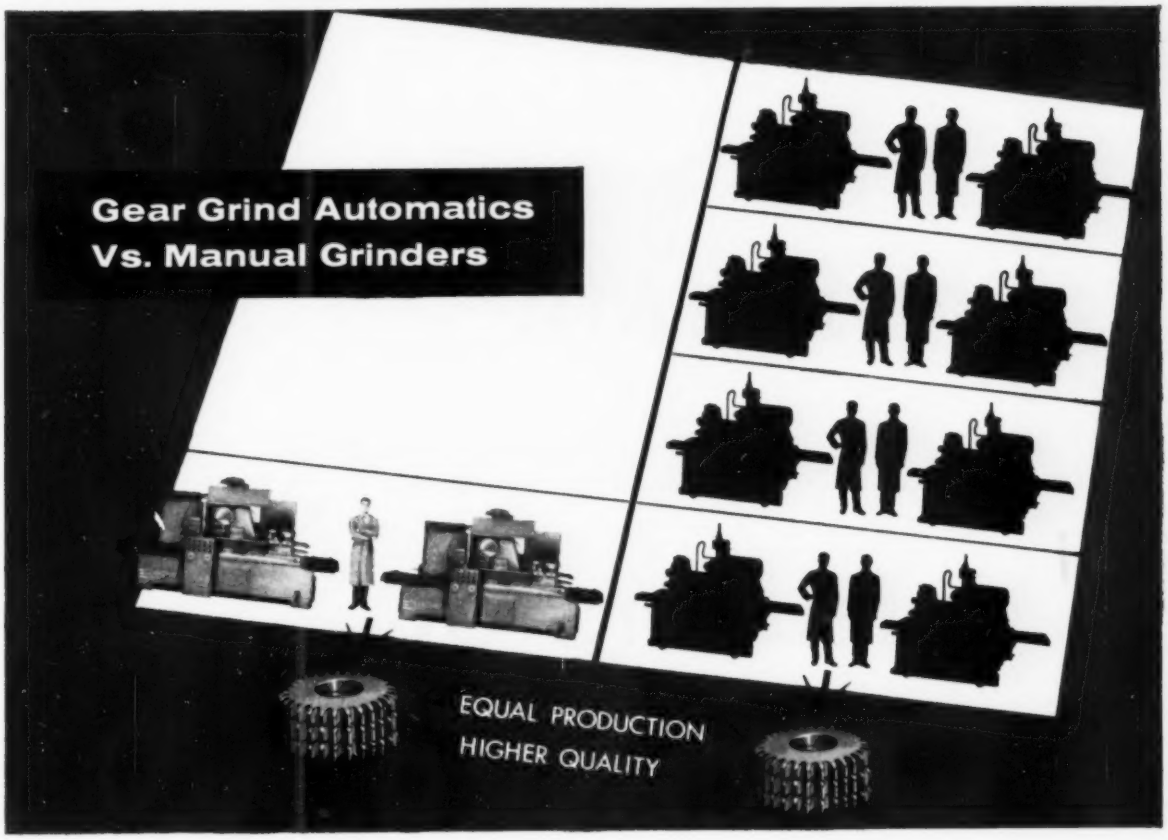
Beatty Buys Quickwork Line

Beatty Machine & Mfg Co, Hammond, Ind, manufacturer of heavy metalworking equipment, has bought the Quickwork line of machine tools from Whiting Corp, Harvey, Ill. This includes stamping trimmers that trim flash from almost any kind of stamping in a single plane, and rotary shears which are used to cut, bevel, circle, flange, and joggle plate and sheet metal from the lighter gages up to 1 in. mild steel.

(Continued on p 168)

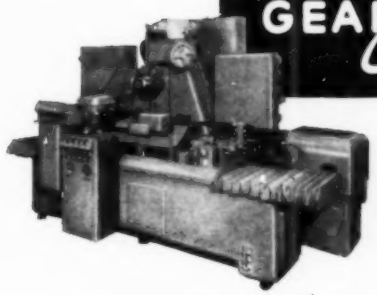
"He rigged up his own remote control—so how could we object?"

Here's real grinding economy!



2 Automatics with 1 Operator Equals 8 Manuals with 8 Skilled Operators

¼ the floor space
¼ the number of machines
⅛ the manpower
} Gear Grinding Economy



GEARGRIND Detroit

PUMP GEAR

PUMP ROTORS
600 pcs./8 hrs./machine

floor to floor grinding cycle—6 minutes for 7 tooth; 12 minutes for 11 tooth

For all the facts—write today!

THE GEAR GRINDING MACHINE COMPANY

Dept. AG-659 3921 Christopher, Detroit 11, Michigan

Manufacturers of:

RZEPPA ("Sheppa") Constant Velocity Universal Joints

CIRCLE 269 READER SERVICE CARD

Important new discovery for users of resinoid-bonded diamond wheels

YOU CAN DEPEND

The Diamond Research Laboratory has just completed one of the most exhaustive research projects ever conducted in the diamond abrasives field. A total of 700 pounds of hardest carbide was ground. Over an eight-month period, 600 separate tests were run with 145 resinoid wheels. These tests were made to evaluate a completely new type of natural diamond grit.

The results are impressive: from 30% to 50% longer wheel life than was possible with the old natural grit. Why the spread? Because there's no such thing as an average job, so you can't strike an average figure. But whatever the job, this new natural grit is a vast improvement.

Selected Natural Diamond (SND-RESINOID) was researched especially for users of resinoid-bonded wheels. This grit will be available to your wheel manufacturer. Next time you order a resinoid wheel, specify SND-RESINOID. He'll know what you mean.

ON NATURAL DIAMONDS

INDUSTRIAL DISTRIBUTORS (SALES), LTD.

Higher-speed operation from built-in gauging

New cam-lever linkage of the Di-Acro Model 36 shear provides a greater mechanical advantage than lever actions. This makes it easier to control both machine and material so that operation is easier, faster, safer.

Quick-Set micrometer gauges set to hair-line accuracy in seconds. The new Model 36 shear is fast to set-up, fast to operate. To maintain tolerances to thousandths of an inch, an automatic hold down bar grips materials during shearing. Notching and slitting can be done easily by setting the adjustable ram stops to limit stroke length. Capacity of the machine is 16 gauge steel.

Steel, rubber, mesh and all shearable sheet materials (even some plastics) can be cut to die-accuracy with the new Model 36.

Similar performance is also delivered by a range of other models down to 6 inches in width. For detailed information, call your Di-Acro distributor who is listed in the yellow pages of your phone book under Machinery—Machine Tools, or write us.

DI-ACRO POWER SHEARS

Di-Acro Shears of 12" and 24" widths are available in power models. The standard model provides continuous and single stroke operation. Vari-O-Speed model shears automatically at a range of speed from 30 to 200 R.P.M. or single stroke.

di-acro PRECISION METALWORKING MACHINES

Find us fast in the Yellow Pages

O'NEIL-IRWIN MFG. CO.
405 8th Ave. • Lake City, Minn.

pronounced "die-ack-ro"

Field Report . . .

tary shears which are used to cut, bevel, circle, flange, and joggle plate and sheet metal from the lighter gages up to 1 in. mild steel.

Rheem Selling Two Calif Units

Rheem Manufacturing Co is selling its facilities at Downey and Riverside to the Aerojet-General Corp. Amount of the cash sale was not disclosed but it's estimated to be between $12 and $15 million. Transaction involves transfer of employees, production, and facilities. The Downey plant was opened at the start of the Korean War to subcontract aircraft parts and subassemblies. Facility at Riverside for machining, loading, and testing ordnance devices has been in operation for a year. Rheem plans to concentrate its defense work in electronics fields.

Shillelagh to Aeronutronic

Army's $23 million Shillelagh surface-to-surface missile development program will be carried out by Aeronutronic Systems, Inc, Los Angeles subsidiary of Ford Motor Co. Missile is expected to be operational by the mid-1960's. This is the first missile system development contract awarded to the automotive industry. Others have received sub-system or production orders, but not development contracts for complete missile systems.

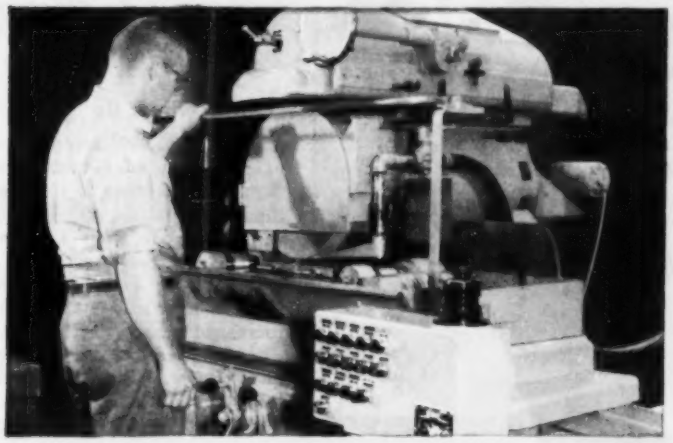
Auto-Lite to Close Plant

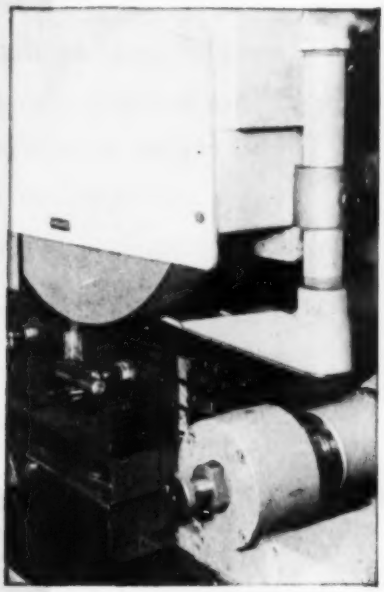
Electric Auto-Lite Co will permanently close its plant in La Crosse, Wis, July 3. Company cites a shrinking market and the "labor climate in La Crosse" as reasons for the shutdown. Facility turns out electric au-

"How come when I'm careless I get spanked and when you're careless you get compensation?"

Thompson — TRUFORMING CUTS COSTS 66%

. . . DOUBLES PRODUCTION AND IMPROVES PRODUCT AT THE OLIVER CORPORATION





In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

The installation of the Thompson Truforming Grinder has accomplished the following results:

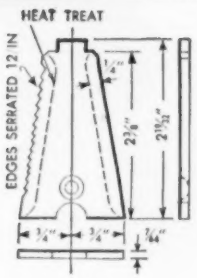
1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

**Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.*

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO



LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

It's lots more ***fun...***

Jim always came home grouchy and complaining about noisy gears and how did they expect him to build precision machines. But ever since the day he said they gave him a real batch of gears, made to order by "CINCINNATI GEAR . . . *he's my boy!*

When it comes to gearing in your product, remember this **profit formula:**

Modern Manufacturing + Old-time Craftsmanship + Precision Inspection = CINCINNATI gears

For guaranteed custom gears and custom gear boxes, send your prints for our quotation.

CINTI

THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio
Custom Gear Makers Since 1907

GEARS, good gears only

Field Report . . .

tomotive parts, employs about 1200. Production will be consolidated at Bay City and Port Huron, Mich, and Toledo plants.

English Firm Opens US Office

Firth Cleveland Ltd, London-headquartered producer of specialty steels, has formed an American organization, Firth Cleveland, Inc, with offices at 60 East 42nd St, New York.

Convair Wages Up

More than 62,000 employees of Convair Division of General Dynamics Corp will receive a total of more than $12 million additional pay in the next year from 3% wage and salary increases effective at various intervals between April 27 and August 3. While starting dates of increased compensation in many cases are tied to contracts negotiated about a year ago with at least seven labor unions in southern California and Texas, 16,866 non-represented hourly and flat-salary employees will receive the same percentage raises.

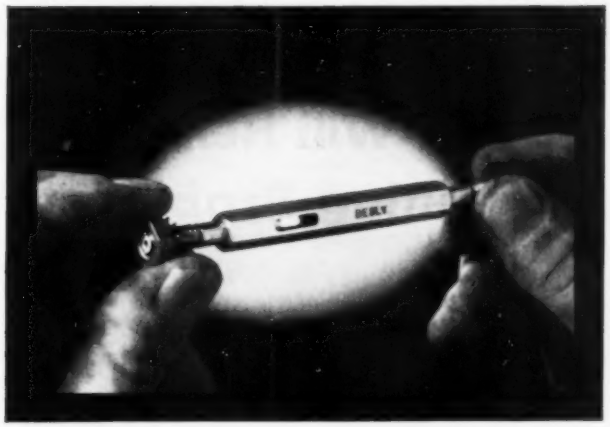
Metalworking Industry . . .

. . . development in the Puget Sound area is expected to be furthered by $25 million worth of new production facilities now in operation at the Seattle plant of Bethlehem Pacific Coast Steel Corp. Included are two electric arc steelmaking furnaces that'll boost the plant's annual capacity to 420,000 ingot tons; a battery

(Continued on p 173)

"If the job was that important, why did you ever let me get my hands on it?"

New Besly CP-75 precision gages last 3-5 times longer



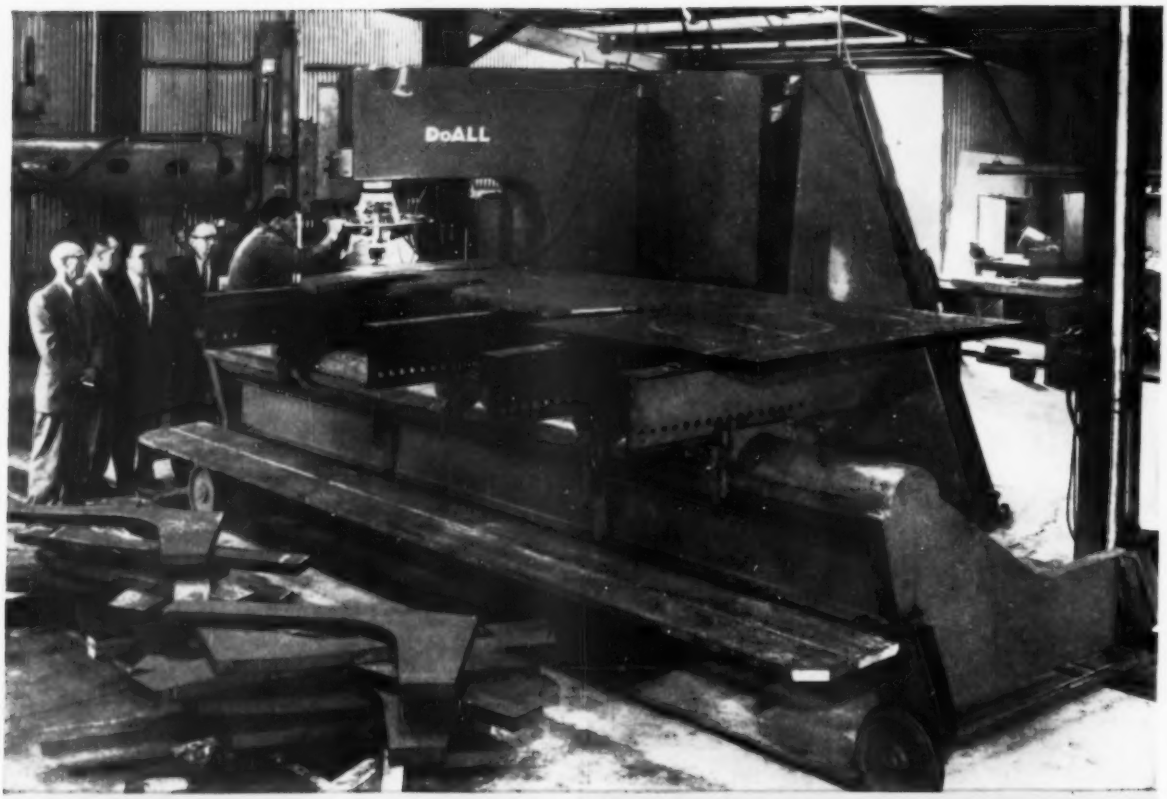
Now you can have Besly Precision Gages in *extra hard* chrome plate. Made to tolerances according to U. S. Bureau of Standards specifications, Besly CP-75 precision gages last from three to five times longer than ordinary steel gages. They give you more piece parts per gage, less downtime for gage inspections, lower gage inventory, and will not chip or peel. See your distributor, or *write us today for catalog giving complete information on our full line and prompt service.*

BESLY®

BESLY-WELLES CORPORATION

120 Dearborn Ave. South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills • Reamers • End Mills • Tool Bits
Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders



Your DoALL Sawing Specialist Will Help You Solve Both Tool and Machining Problems

Faced with the problem of making complex cuts in massive plates of cross-rolled, bi-directional steel, Shultz Steel Company, Los Angeles, sought answers to two questions: 1. What method should be used? 2. Could the work be mechanized and still get accuracy, fine finish, and speed?

To take advantage of DoALL's research and development work in metal cutting, it was logical to call in Erik Franzen, Sawing Specialist of DoALL Western Company. Working closely with Shultz Steel executives, he helped solve this difficult problem with a DoALL Pan-Arm* Contour Saw. This is the *only* machine on which it is possible to guide the saw blade through the work without moving the king-size plates—often weighing up to 8000 lb. Demon* High-Speed Steel Blades make the required cuts directly to a layout line with accuracy, fine finish, good cutting rate and low tool cost.

More than 200 DoALL Sawing Specialists, from coast to coast, are ready to give you the benefit of their experience on your machining problems. Call your DoALL Specialist today. His expert help—and the help of the DoALL Sawing Research Laboratory—is free.

Shultz Steel Company executives watch a demonstration of the Pan-Arm Contour Saw as the machine makes cuts in any direction—in a 99-sq.-ft. area. The work remains stationary on the table.

*Reg. T.M.—The DoALL Company

SB-77

THIS IS A TYPICAL DoALL STORE

The DoALL Company, Des Plaines, Illinois

Call Your DoALL Service-Store

Field Report . . .

of eight soaking pits; a 32-in. blooming mill; and a 12-in. merchant bar mill capable of producing a wide range of rolled products at high speed. Program also included extensive modernization of the 22-in. rolling mill, and a new three-high mill for rolling plate up to 30-in. wide will be installed in the fall.

British Aviation Exports Soar

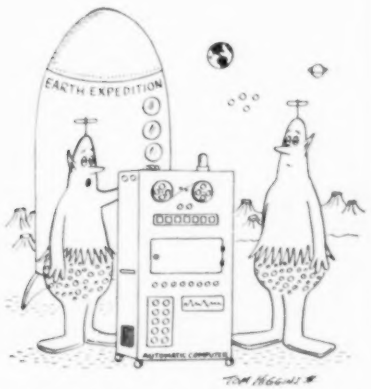
Exports during the first quarter of 1959, valued at more than $123 million, were a record for any three-month period, according to the Society of British Aircraft Constructors. Aircraft and parts accounted for $70.3 million ($65 million in corresponding period of 1958), and aero engines for $39 million of the total. India continued as Britain's best customer, taking aircraft and parts worth $10.5 million. Argentina followed with $8 million, and West Germany with $7 million. Sales to the US were valued at $4.5 million.

$4.5 Million Magnesium Plant . . .

. . . of Alabama Metallurgical Corp, now under construction at Selma, is scheduled to begin production Sept 1. High quality magnesium produced there will be used as a reduction agent in the production of rare metals.

GE Gets Air Force Contract

General Electric's plant at Lynn, Mass, has a $1.3 million order for construction of three 7500-kw steam turbine generating units for use in connection with the ballistic early warning system at Clear, Alaska. Contract, originally awarded to the company of Brown Boveri in Switz-



"I captured one of the earthlings but I can't tell whether it's male or female."

"POP" RIVETS

Insert and Set From Same Side
Cuts installation costs in half.

High Clinching Action
Pulls parts together with up to 600 lbs. squeeze. Eliminates need to clamp.

Wide Grip Range
Simplifies inventory, purchasing, inspection. Same length "POP" Rivet holds tight through thick or thin.

Vibration Proof
"POP" Rivets cannot back out or become loose. Ensures tight assembly for years of use.

Low Head Profile
Where space is important, "POP" Rivets' minimum head height eliminates clearance problems and improves appearance.

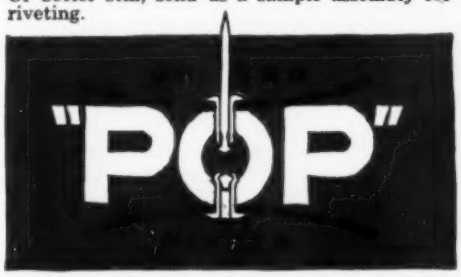
Least Back-Up Space
Strong, high strength "POP" Rivets need only enough back-up space to provide room for set head. Gives more compact design.

- **Cut Assembly Costs**
- **Solve Design Problems**
- **Installed and set from same side**

"POP"® Rivets cut *installed fastener costs*, add design flexibility, and increase assembly convenience because they are inserted and set from the same side. Up to 1200 can be set per hour right on the assembly line — even by an unskilled operator.

"POP" Rivets are precision made, hollow rivets assembled on a solid high tensile mandrel. The setting tool pulls the mandrel head into the rivet from the front side, setting the rivet on the reverse side. Mandrel breaks under tension of up to 1600 lbs. and falls free.

You can cut installed costs, increase assembly convenience, and secure high speed, trouble-free fastening immediately with "POP" Rivets. No need for complicated or extensive re-tooling. Simplify product design, cut handling time. Call or write us today — now — and start cutting your *installed fastener costs* with "POP" Rivets! Or better still, send us a sample assembly for riveting.



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UNITED SHOE MACHINERY CORPORATION
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With This New Automatic Infeed Grinding Attachment

Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

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Subsidiary of

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Open Territories for Manufacturers' Representatives

Field Report . . .

erland, was transferred to GE (the second low bidder) because the Swiss firm could not meet delivery dates and had misinterpreted some specifications.

Riverside Plastics Buys Plastics Coatings Firm

Bischoff Chemical Corp, owned by Miles Laboratories, has been purchased by Riverside Plastics Corp of Hicksville, NY. Bischoff makes Thermo-Cote protective strippable plastic coatings used for protection of metal cutting tools and parts. Acquisition provides Riverside with added facilities for production of its own new high temperature resins for reinforced plastics components. It'll continue to produce and market the Bischoff coatings.

Brush Beryllium Expanding

The Cleveland company is establishing a facility in the San Francisco area. It'll be equipped for fabrication and machining of beryllium components for use in aircraft, missiles, and inertial guidance, as well as for nuclear and other fields of application. The associated regional sales office will also handle beryllium oxide and other beryllium products of the company.

Remington Rand Univac . . .

. . . Philadelphia division of Sperry Rand Corp, plans to expand its commercial engineering activities during the coming year; it'll centralize commercial activities in Philadelphia. Facilities in St Paul, Minn, which previously carried out both commercial and military projects, will concentrate on the latter. Commercial projects now under way in St Paul will be transferred to Philadelphia.

Hercules Has $22 Million Job

Hercules Powder Co, Wilmington, Del, has a $22.6 million contract from Army Ordnance Ammunition Command to continue operation of the Radford, Va, Arsenal for production and loading of missile, rocket, and cannon propellants. Company has operated the Arsenal since 1941. More than half of the order involves propellants for Nike booster engines and Honest John missiles.

Hamilton Standard . . .

. . . Windsor Locks, Conn, Division of United Aircraft is setting up a new department for design, development, and manufacture of specialized ground support equipment for missiles and aircraft. Division has for many years been providing ground support equipment in the form of service tools for propellers, and its Broad Brook plant currently is producing complex equipment for checking out of air conditioning systems and electronic components in the supersonic Convair B-58 bomber.

American Electronics' New Division

Los Angeles company has formed an American Data Division, Brooklyn, to handle design, manufacture, and marketing of its peripheral data processing equipment. New division will also handle the complete line of printers and special instrumentation designed by its R&D group.

Kaiser Steel Corp's . . .

. . . Fabricating Division plant at Napa, Calif, has a $2.5 million order to manufacture the major equipment for Japan's first large diameter pipe mill. New mill, capable of producing pipe from 18 through 40 in. in diameter, will be installed as a unit in the integrated steel operations of Japan Steel & Tubes Co, nation's third largest steel producer. Machinery made at Napa will include a pipe forming line, welding equipment, a hydraulic expander, and related finishing equipment.

Du Pont Building in SC

Du Pont plans to put up a $20 million film manufacturing plant 10 miles east of Florence. New facility will make Mylar, a polyester industrial and packaging film. The South Carolina project will double the firm's output of the product, now being made only at the Circleville, Ohio, plant.

"When someone causes the company $35,000 worth of damages, Busino, we don't refer to it as having made a boo-boo."

The pitman connection of the new Oliver-Farquhar O. B. I. Mechanical Gap Press provides two basic advantages... easy slide and die adjustment and extra strength.

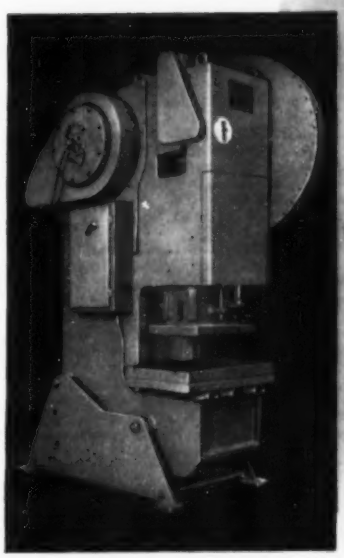
This Oliver-Farquhar Press has

STRENGTH

where you need it...

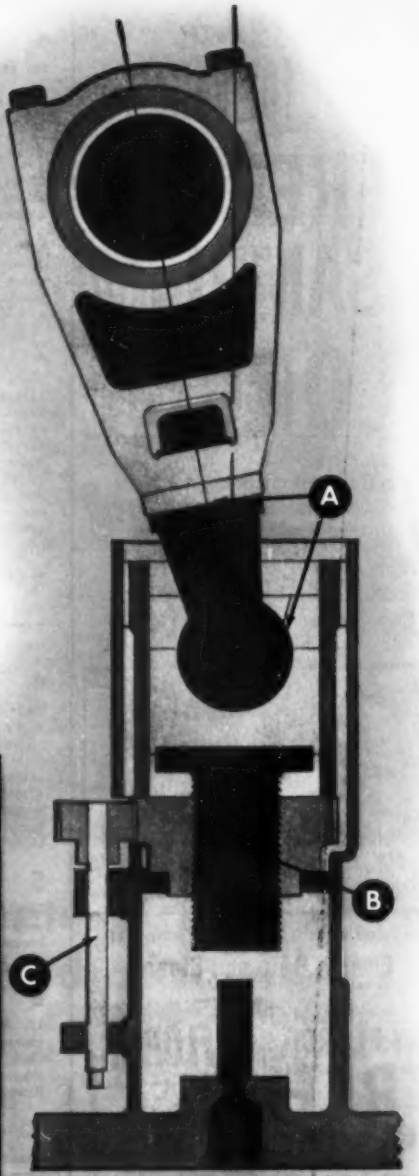
Easy slide adjustment

where you want it...



The Oliver-Farquhar O. B. I. Mechanical Gap Press has a heavy-duty barrel type pitman connection with the slide adjusting screw fully guided to eliminate side thrust and bending loads on the screw. It withstands the full loads of the press at each stroke and the shocks developed in pressing and stripping. There is no danger of bent screws and cracked or broken pitmans. For faster, easier floor level slide adjustment, a simple, directly connected shaft extends to lower end of slide. No special wrench is required for this manual adjustment.

Oliver-Farquhar O. B. I. Mechanical Gap Presses have many features—in addition to the strong pitman connection—that guarantee years of dependable, efficient service. They are available now for delivery in four standard models: 75, 110, 150 and 200-ton capacities.



Oliver-Farquhar design... (A) Critical areas are thoroughly supported for maximum strength. (B) Fully guided adjusting screw is held firmly in base. (C) Easy, floor-level adjustment.

Write, wire or phone for complete details or ask for our recommendation.

OLIVER Farquhar PRESSES

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A. B. FARQUHAR DIVISION • *Press and Special Machinery Departments* • YORK 15, PA.

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It is the most effective, practical and economical adsorbent for industrial and commercial use.

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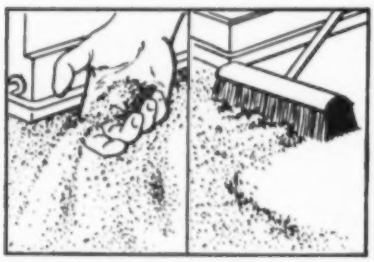

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MACHINES AND ATTACHMENTS

1 METAL LATHES—*Rockwell Manufacturing Co, Delta Power Tool Division, 457 N Lexington Ave, Pittsburgh 8, Penna.* 20-page catalog illustrates and describes complete line including 10-in. model with variable speed drive and ¾-in. collet capacity; 11-in. model with 4-ft bed; 11-in. model with 5-ft bed; and hand screw machine. Includes catalog listings, specifications, accessories, and a full page on motors and controls.

2 MULTIPRESSES—*American Brake Shoe Co, Denison Engineering Division, 1160 Dublin Rd, Columbus 16, Ohio.* 32-page revised, expanded 1959 edition of brochure discusses function and operation of company's line. Illustrations, schematics, specifications, and performance characteristics have been added on new Series E (2 to 8-ton) models; 2-ton Series A unit; and the 4-column platen Multipress for die cast trimming, pelleting, progressive die production, and specialized types of assembly.

3 SPECIAL AIR AND HYDRAULIC MACHINES — *Logansport Machine Co, Logansport, Ind.* 4-page bulletin 7-A 4-59 contains illustrated description of typical custom-engineered machines.

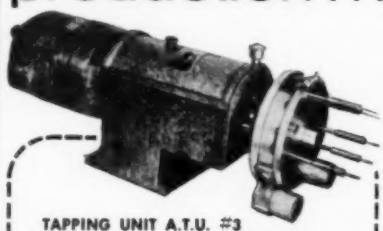
4 RADIAL DRILL — *American Tool Works Co, Cincinnati 2, Ohio.* 12-page bulletin 327 presents detailed information on new Maxi-Speed Hole Wizard Radial added to line. Designed to handle medium class of drilling, tapping, and boring operations, these utility models are available in column diameters from 13 to 17 in. and arm lengths from 5 to 8 ft. Construction features illustrated and described; specifications and dimensions tabulated.

5 FAMCO MILLS—*Famco Machine Co, 31000 Sheridan Rd, Kenosha, Wis.* Illustrated bulletin provides data on mills with hard chrome plated ways and leadscrews. Way curtains and optical vernier also pictured and described.

6 BROACHING — *National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich.* 8-page illustrated brochure discusses broaching: machines, tooling, design, materials, trends, products produced through specific tooling designs, broaching fixtures.

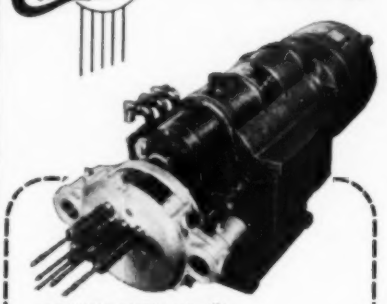
7 JIG GRINDING MACHINE — *Carl Hirschmann Co, 30 Park Ave, Manhasset, LI, NY.* 23-page catalog gives information on the Hauser 3SM precision

The Tap and Drill Team for your hole production...



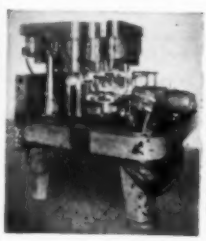
TAPPING UNIT A.T.U. #3
Completely self-contained all-electric lead screw precision unit. Quickly interchangeable for fast single or multiple spindle head operation. With forward and reverse electromagnetic clutches and variable torque control.

Ettco-Emrick TAP & DRILL TWINS



DRILLING UNIT D.U. #2
Completely self-contained precision unit with powerful air feed and hydraulic control. Quickly interchangeable for fast single or multiple spindle head operation.

Used singly or in combination they offer the flexibility and adaptability to meet modern drilling and tapping requirements. When combined with Ettco-Emrick multiple spindle heads they'll set new standards of precision, speed and economy.



SPECIAL MACHINES
Building the Twins into high production special machines is simple, because all units are electrically controlled and all components are standardized equipment. We can supply the assembly complete with tooling — or you can do it in your own plant.

Write for details

Authorized distributors in U.S. and Canada

ETTCO TOOL & MACHINE CO., INC.
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The only full line manufacturer covering the entire small hole field: Tapping Attachments • Multiple Heads • Drilling & Tapping Units and Machines • Special Machines • Indexing Fixtures • Tap & Drill Chucks

New Bliss ball bearing die sets shrink hours into minutes in die making and changeover!

Here are seven reasons why...

- Negative clearance means longer die life. No die shifting. Misalignment is eliminated.
- Ball bearing construction speeds assembly and disassembly. Yet installation is conventional. Die builder doesn't work in reverse.
- Smooth even preloading prevents shock...assures alignment of punch and die. Off-set design reduces wear.
- Easy oiling and maintenance. Loosen the set screw, the retainer is out and back in minutes.
- Eliminates downtime caused by seized pins and bushings.
- Standard components – no need to stock or wait for specials.
- Existing sets can be easily and economically converted to Bliss-Dieco ball bearing design.

Mfd. under U. S. Pat. 2,311,815

Note: Bliss-Dieco ball bearing assembly can be stripped from guide post on inclinable or straight side presses.

Bliss' patented ball bearing die set has money and time saving advantages no other die set has—conventional or otherwise. It gives you more burr-free parts between regrinds... fewer rejects.

It's the most revolutionary change in bearing design to hit the die industry in years. Assembly and disassembly are a snap. Die making and tryout time are slashed. No more time lost because of seized pins and bushings.

Pre-loaded ball bearings provide *negative clearance* for perfect die register, even after millions of hits.

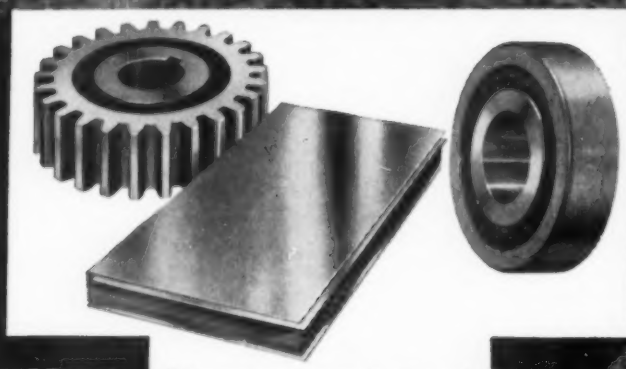
What's more, cleaning and lubrication are a matter of minutes with this unique die set: You just loosen the self-locking set screw, drop the bearing retainer, clean it, reposition it and tighten the screw again. Light bearing oil is all that's needed.

In short, with the Bliss ball bearing die set you get maximum die life—"cleaner" parts – fewer die breakdowns. For further information, write E. W. Bliss Company, Die Supply Division, 1400 Brookpark Road, Cleveland, Ohio. We'll be glad to send you an illustrated technical bulletin that will tell you how you can have ball bearing die sets at a surprisingly low cost or how you can convert your existing die sets to the new Bliss-Dieco design.

dieco
DIE SETS

E. W. BLISS COMPANY
DIE SUPPLY DIVISION
Cleveland, Ohio

VALVOLINE
Tectyl
protects metals against RUST



VALVOLINE's amazing Tectyl rust preventives protect metal surfaces against *every kind of rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against . . . sun and rain . . . heat and cold . . . salt air and salt water . . . humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy and Air Force "Specs" and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the entire field.

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unit. Machine and its components illustrated; technical data included. Four pages cover more than 127 special and standard accessories.

8 ALUMINUM MACHINING CHART —*Peter A Frasse & Co, 17 Grand St, New York 13, NY.* 8½ x 11-in. chart (Sec G, No. 2) gives tables of recommended speeds and feeds for six different machining operations: forming, turning, drilling, boring, reaming, and cutting off. Cutting speed conversion table is included.

TOOLS AND ACCESSORIES

9 MACHINISTS' TOOLS — *Brown & Sharpe Mfg Co, Providence, RI.* 48-page catalog 37M illustrates and describes all items normally used by machinists and toolmakers. Includes dimensions, capabilities, applications, prices.

10 LUBRICANT SELECTOR CHART— *Alpha-Molykote Corp, Stamford, Conn.* Bulletin 121 facilitates choice of the proper lubricant for practically any extreme pressure job. Evaluates every type in the Molykote lubricant line based on temperature, environment, method of application, incorporation into common materials, and recommendations for various parts, operations, and conditions. Brief technical description of each Molykote type is included.

11 MACHINE TOOL CLAMPS—*Hi-Lo Products Co, 8817 Lyndon Ave, Detroit 38, Mich.* 2-page brochure 858 illustrates all components of the Hi-Lo clamp starter set; shows how adjustable clamps are used to secure workpieces on bolster plates and machine tool tables. Also illustrated are larger sets available for complete Hi-Lo clamping systems.

12 CUTTING OILS—*Gulf Oil Corp, Dept DM, Gulf Bldg, Pittsburgh 30, Penna.* Ten different types of cutting oils which provide for every metal cutting need are described, including new Gulfcut Heavy Duty Soluble Oil, especially formulated to deliver better results on any job where an emulsifying cutting fluid can be used.

13 BLACK GRANITE GAGING PRODUCTS—*DoAll Co, 254 N Laurel Ave, Des Plaines, Ill.* 12-page brochure includes a selector chart listing 432 combinations of plate sizes, ledges, and over-all accuracies

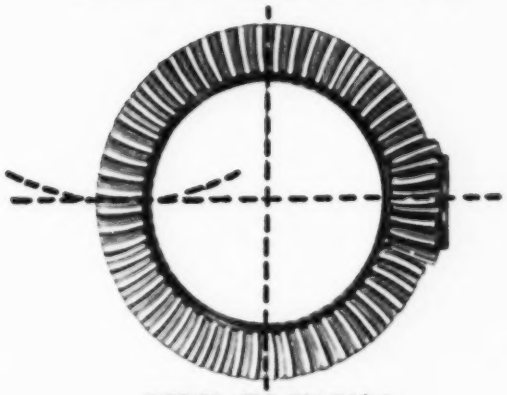
(continued on p181)

"Well, you were the one who ordered me to give her half of the car, half of the refrigerator, half. . ."

DO YOU KNOW YOUR BEVEL GEARS?

STRAIGHT TOOTH (TO 98″ DIA.)

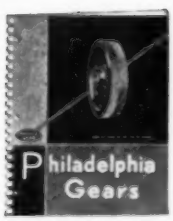
SPIRAL BEVEL (TO 72″ DIA.)



ZEROL (TO 72″ DIA.)

HYPOID (TO 48″ DIA.)

phillie gear makes them all



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Phillie Gear is equipped with the "know-how", the manpower, and latest facilities to manufacture the entire family of Bevel Gearing—sizes and capacities range from the very small to the most massive sizes obtainable. Ultra Precision ground tooth Spiral Bevel Gears are available up to 23″ diameter.

All types and sizes of gears produced by "Phillie" are made to the highest standards of Engineering skill and exactitude—they are the culmination of over 65 years' experience, and are produced on the very latest machines by skilled craftsmen—In a nutshell, Phillie Gear offers, not only the finest gears obtainable, but prompt and courteous service as well.

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"We just changed our steel supplier"

"For 18 years we bought our steel from the same people. But with a string of new products, we had trouble getting the types we needed. Saw an ad recently that looked like an answer. Showed it to some of the boys on the Purchasing Committee and found they'd noticed it too. We got the salesman in and the new set-up has cut down steel supply troubles."

Among hard-to-reach Metalworking production men like our typical but hypothetical Mr. Schlictmann, that's frequently the way sales start. With so much buying handled by committee action, it's a problem to keep in contact with this group. In today's changing technology, you do this best in the technical publications these men read.

With Metalworking production management, this is usually American Machinist. Written and edited for production engineers and executives in Metalworking, it's consistently regarded as the "most useful" publication in the field. Thus, more of them subscribe to it than any other Metalworking publication. That's why so many Metalworking men tell you . . .

"I have to read American Machinist"

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330 West 42nd Street, New York 36, New York

Free Literature

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to simplify selection of a surface plate. Three different grades are offered with tolerances of 25, 50, and 100 millionths. Also covers plate stands and gaging accessories such as angle plates, straight edges, parallels, magnetic chuck platforms, master flats, and deburring stones.

14 CARBIDE-TIPPED SAWS — *H K Porter Co, Disston Division, Philadelphia 35, Penna.* 8-page illustrated section of new catalog contains descriptions of use, selection guide for proper diameter, number of teeth and saw speed, plus care and handling.

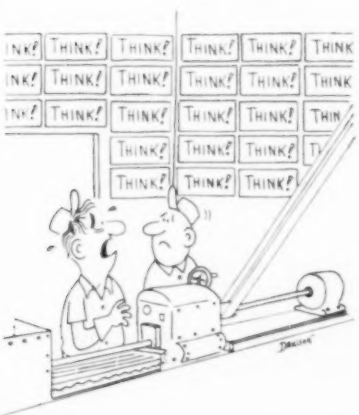
15 MAGNIFIERS AND READERS — *Bausch & Lomb Optical Co, 635 St Paul St, Rochester 2, NY.* 14-page illustrated catalog I-52 lists more than 65 individual models (powers from 2x to 20x) including round and rectangular readers, folding pocket magnifiers, watchmaker's loupes, surface comparators, enlarging focusing magnifiers. Specifications and list price included for each item. Introduction provides tips on correct working distance, field of view, and proper type of magnifier for individual job requirements.

16 ALL-PURPOSE JAW CLAMPS — *J & S Tool Co, 87 Dorsa Ave, Livingston, NJ.* Literature describes jaw clamps that eliminate use of U-clamps, straps, and fingers. Specifications, pictures, and diagrams included of these units which secure work quickly and rigidly and are easily adapted to box fixtures.

17 ENGRAVING MACHINE ATTACHMENTS AND ACCESSORIES—*H P Preis Engraving Machine Co, 204 Industrial Branch, US Highway 22, Hillside, NJ.* 20-page catalog illustrates and describes such items as cutter grinders, electro-markers, adjustable copy holder units, single copy slides, tracing styles, workholding devices, master index fixtures, cutters, collets, master copy type, stock master templets.

PLANT SERVICE EQUIPMENT

18 MAINTENANCE COATINGS—*Carboline Co, 32 Hanley Industrial Court, Brentwood 17, Mo.* 4-page chart No. 5 compares 17 standard systems showing strong and weak points of each. Accurate resistance ratings are listed for acid, alkali, solvent, water, weathering, flexibility, im-



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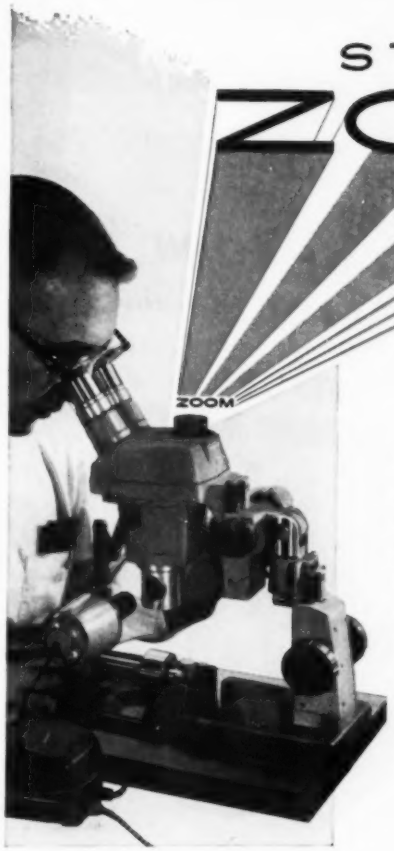
give you

STEREO ZOOM



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Here's a completely new optical concept to speed and simplify work requiring 3D views. Just turn the magnification knob and watch the brilliant stereo image zoom to the *exact* size you need. Not just a few fixed powers, but *any* power within the wide stereo range. The newest step forward to faster, easier 3D work . . . and it's exclusive with Bausch & Lomb.

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- Sealed to prevent dust and foreign matter from entering optical system!
- No nosepiece!
- No individual objectives . . . no objectives to change!
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***Featuring* NEW LOW PRICE**

. . . about one-third lower than previous line!

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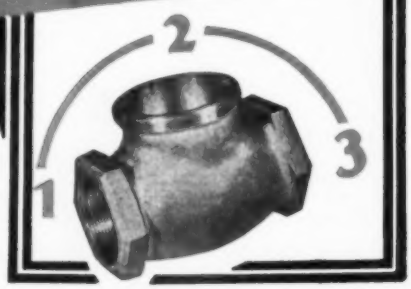
ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

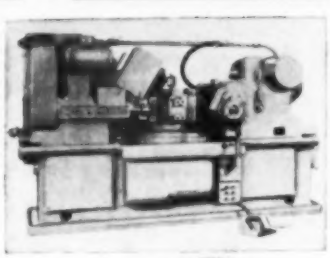


This recent Gross & DeLeeuw development has already received universal acclaim as an outstanding achievement.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages also apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

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QUALITY PRODUCT-QUANTITY SPECIALTY

GOSS *and* DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

pact and abrasion, and temperature conditions. Surface preparation discussed.

19 VIBRATION AND NOISE CONTROL — *Korfund Co, 48-32B 32nd Place, Long Island City, NY.* 8-page booklet K4E gives engineering specifications and performance data for 27 types of products for the control and measurement of machinery vibration, shock, and noise. Discusses relative merits of steel springs and organic materials as isolation media. Selector chart covers range of equipment, showing recommended and alternate methods of isolation, also indicates when concrete foundations are necessary.

20 ELECTRIC HOISTS—*Northern Engineering Works, 210 Chene St, Detroit 7, Mich.* 12-page bulletin H-113 illustrates and describes features of Hi-Lift low-headroom heavy-duty units. Ratings and dimension tables included for a variety of types.

21 INTERNAL GEAR ROTARY PUMPS—*Wayne Pump Co, Griffin St, Fort Wayne, Ind.* Four 4-page brochures and two 2-page bulletins contain illustrated descriptions of standard pump series A, B, C, and D, plus steam jacketed Series E and Series C and D in 200 and 300-gpm capacities. Lists typical liquids handled by each; includes construction options and details, specifications, assembly recommendations depending on application, and dimensional data. Dimensions for V-belt and gear driven assemblies tabulated.

22 ABRASIVE PRODUCTS—*Carborundum Co, Niagara Falls, NY.* Wall chart lists specifications in quick reference form on die barbering wheels; sticks, stones, and rubs; and finishing compounds. Pictures of products supplement mathematical data.

23 MATERIALS HANDLING EQUIPMENT — *Tri-State Engineering Co, 295 W Beau St, Washington, Penna.* 7-page bulletin B-100 describes and pictures complete line including various models of Cargotainers, conveyor guard, and pallets. Specifications chart gives data on sizes, weights, and capacities of Cargotainers.

(Continued on p 184)

"I like a man with your attitude, Wenzel . . . But not in my department—You're fired!"

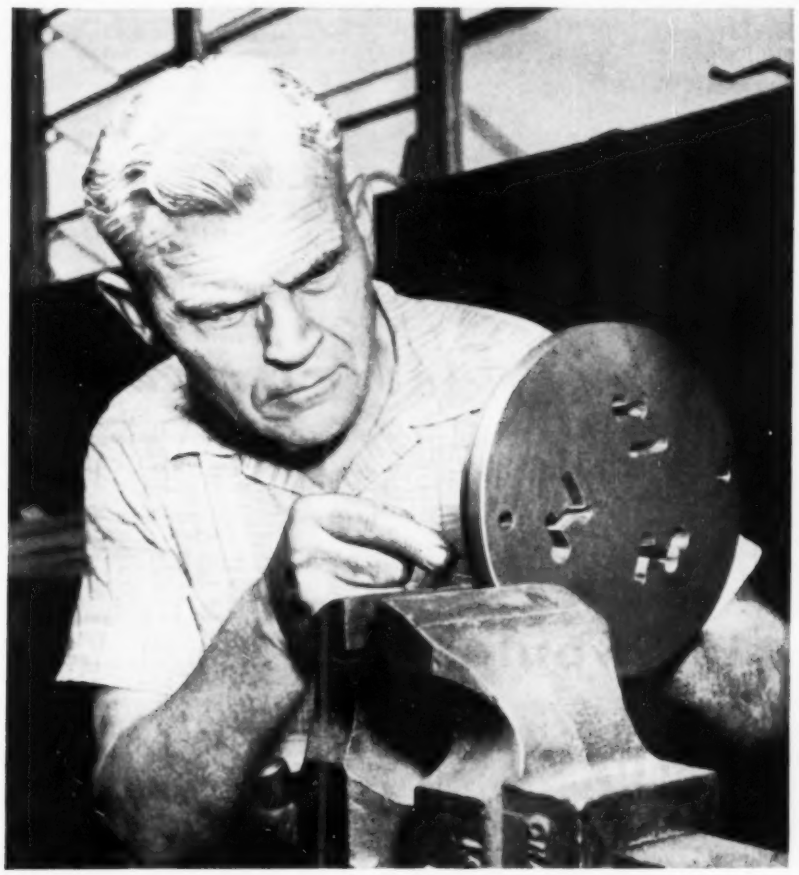
Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Making "3-in. edge" extrusions with die of Cromo-WV

A manufacturer in the Southeast needed a long wearing hot-work tool steel to produce a "3-in. edge" extrusion made of aluminum. They talked it over with our local tool steel distributor who recommended making the die from a Bethlehem Cromo-WV upset-forged disc.

It was a good choice. The disc machined readily, and was easy to heat-treat. Hardened to Rockwell C47, the die extrudes 24 billets per hour, with brief stops for polishing. The life of the die is about 50,000 lb of extruded metal.

Cromo-WV, with its 5 pct chrome content, plus .30 pct vanadium, is a modification of our popular Cromo-W, the original 5 pct chrome hot-work steel. Resistant to heat checking, Cromo-WV also has good red hardness, and good shock resistance.

Like to give Cromo-WV a try? Just call your Bethlehem tool steel distributor. You'll find he will handle your request promptly.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Drilled Holes Are Not Round (Usually)

Round holes which are drilled in tool steel stock with twist drills, if measured accurately, are usually found to be: 1. out of round; 2. oversize (compared with drill diameter); and 3. tapered throughout their depth. In other words a half-inch-diameter hole cannot be drilled with a half-inch-diameter drill.

This condition results largely from mechanical "play" in the drilling equipment, although many other factors can exert considerable influence. For example, if the two ground lips which form the cutting edges of a twist drill are unequal in length, the drill will produce holes of irregular size and shape.

The production of parts containing accurate round holes is most commonly accomplished by rough-drilling the holes undersize, and then either reaming or broaching to obtain the desired size.

Bethlehem Air-4 Is an Ideal Free-Machining Grade

Air-4, Bethlehem's new medium alloy tool steel, is an ideal free-machining grade due to the addition of lead. It hardens in air at 1525F to 1575F, and provides excellent wear and high toughness. Air-4 is also a deep-hardening grade, with high compressive strength. Order it today from your Bethlehem tool steel distributor.

Which backing would you specify ...and why?

In the above picture, the backing on the abrasive belt at right is Jeans, a lightweight, flexible cloth used chiefly in woodworking applications. The Drills cloth backing on the left is a heavy, extremely durable cloth used for all types of metal grinding operations. They are but two of many different types and weights of cloth, paper, fibre, and combination backing materials. Choosing the *right* one for your particular application can make a big difference in your product finishing costs. Which is why more and more manufacturers turn to the expert recommendations of Jewel Brand Abrasives Engineers. If the right choice is up to you, call on them for the backing you need. Write for details. Abrasive Products, Inc., 561 Pearl Street, South Braintree, Mass.

belts
rolls
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specialties

JEWEL BRAND

COATED ABRASIVES

ABRASIVE PRODUCTS, INC., South Braintree 85, Massachusetts

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

24 HEAVY DUTY FLOORING MATERIALS—*Walter Maguire Co, 60 E 42nd St, New York 17, NY.* 4-page bulletin 659 illustrates and provides information on paving, patching, and grouting materials and brick, all emery-based, and bonding and curing agents, plus information on a special formulation with emery aggregate designed for heat resistance. Section provides estimating data indicating quantities of the various products normally required per unit of floor space to be paved.

25 CASTERS — *Faultless Caster Corp, Dept PR-74, Evansville 7, Ind.* 24-page catalog 159 contains illustrations, descriptions, and specifications of swivel-plate and rigid-plate truck casters with load capacities ranging from 100 lbs to 15,000 lbs each. Also covers spring-action, V-grooved, grease-sealed, and scaffold casters, floor truck locks, and industrial wheels in wide choice of treads.

PARTS AND MATERIALS

26 REACTOR METALS—*Metals & Controls Corp, General Plate Division, Attleboro, Mass.* 8-page technical data bulletin IND-20 describes forms and sizes of GP reactor metals: boron-stainless steel alloys, hafnium, niobium, tantalum, vanadium, zirconium, and zircaloy. Contains maximum and minimum specifications, tolerances and thickness ranges for materials in sheet, strip, foil, wire, seamless tubing, clad and alloy forms.

27 COPPER TUBE AND PIPE—*Scovill Manufacturing Co, 99 Mill St, Waterbury 20, Conn.* 4-page bulletin provides data on full range of types, sizes, and forms. Two additional pieces of literature cover general commercial tube in copper, copper-zinc, leaded brasses, and tin brasses, and heat exchanger tube.

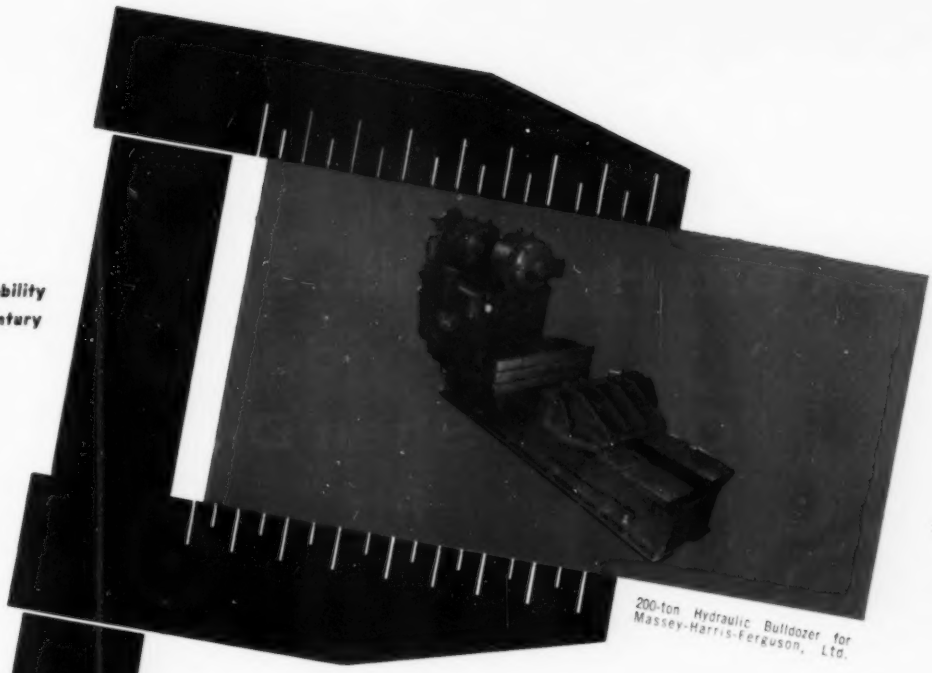
28 BUSHINGS FOR PLASTIC JIGS—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* Catalog 355811 provides data on new line of drill jig bushings for use in plastic jigs and fixtures. Illustrates and describes Trans-Lok bushings and bushing liners for embedding in castable materials, and Press-Lok bushings for pressing into drilled holes in plastics, wood, or soft metals. All standard sizes listed.

29 TIMING BELT DRIVE—*Allis Chalmers, Milwaukee 1, Wis.* 4-page bulletin 20B8760 illustrates and describes new Time-Tex drive constructed with steel ca-

(continued on p188)

"And then one day what they were doing in engineering began to make sense to me."

the measure of
Performance Reliability
for more than a century



200-ton Hydraulic Bulldozer for Massey-Harris-Ferguson, Ltd.

The proven work horse
for bending, forming and forging—

WILLIAMS-WHITE BULLDOZERS

Williams-White, originator of the bulldozer, makes them a little bit stronger, a little bit more versatile, and more accurately and easily controlled. Full range of 50 to 500 ton standard self-contained hydraulic models, or individually engineered and built to meet your special requirements. *Request Bulletin No. 73* for data and specifications.

106th year

WILLIAMS-WHITE & CO • MOLINE, ILLINOIS

When you buy a machine you buy creative engineering skills and craftsmanship. Among your chief considerations should be the record and integrity of the maker.

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SALES AGENTS: Portland, Ore.: Allied Northwest Machine Tool Corp.; **Los Angeles:** Engen Industrial Co.; **Philadelphia:** Edward A. Lynch Machinery Co.; **Milwaukee:** Pagel Machinery Co.; **Seattle:** Perine Machinery & Supply Co., Inc.; **Chicago:** Polhemus-Miller Co.; **Pittsburgh:** Frank Ryman's Sons; **Cincinnati, Columbus** and **Dayton:** Seifreat-Elstad Machinery Co.; **St. Louis, Kansas City** and **Tulsa:** Robert R. Stephens Machinery Co.; **Buffalo:** H. D. Thweatt Co.

ROCKFORD MACHINE TOOL CO. 2500 KISHWAUKEE STREET ROCKFORD, ILLINOIS

SPEED and VERSATILITY

of

Rockford Hy-Draulic Shaper-Planers

provide

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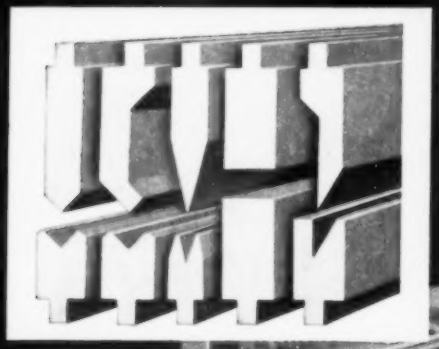

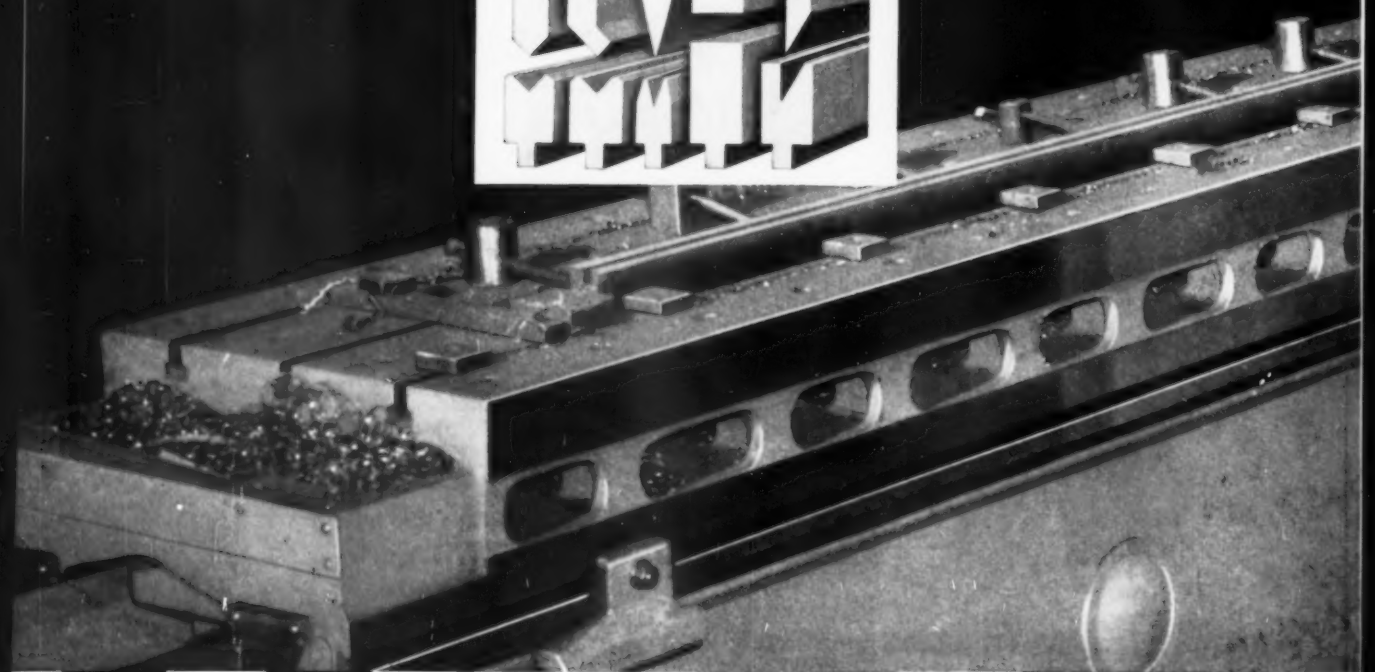

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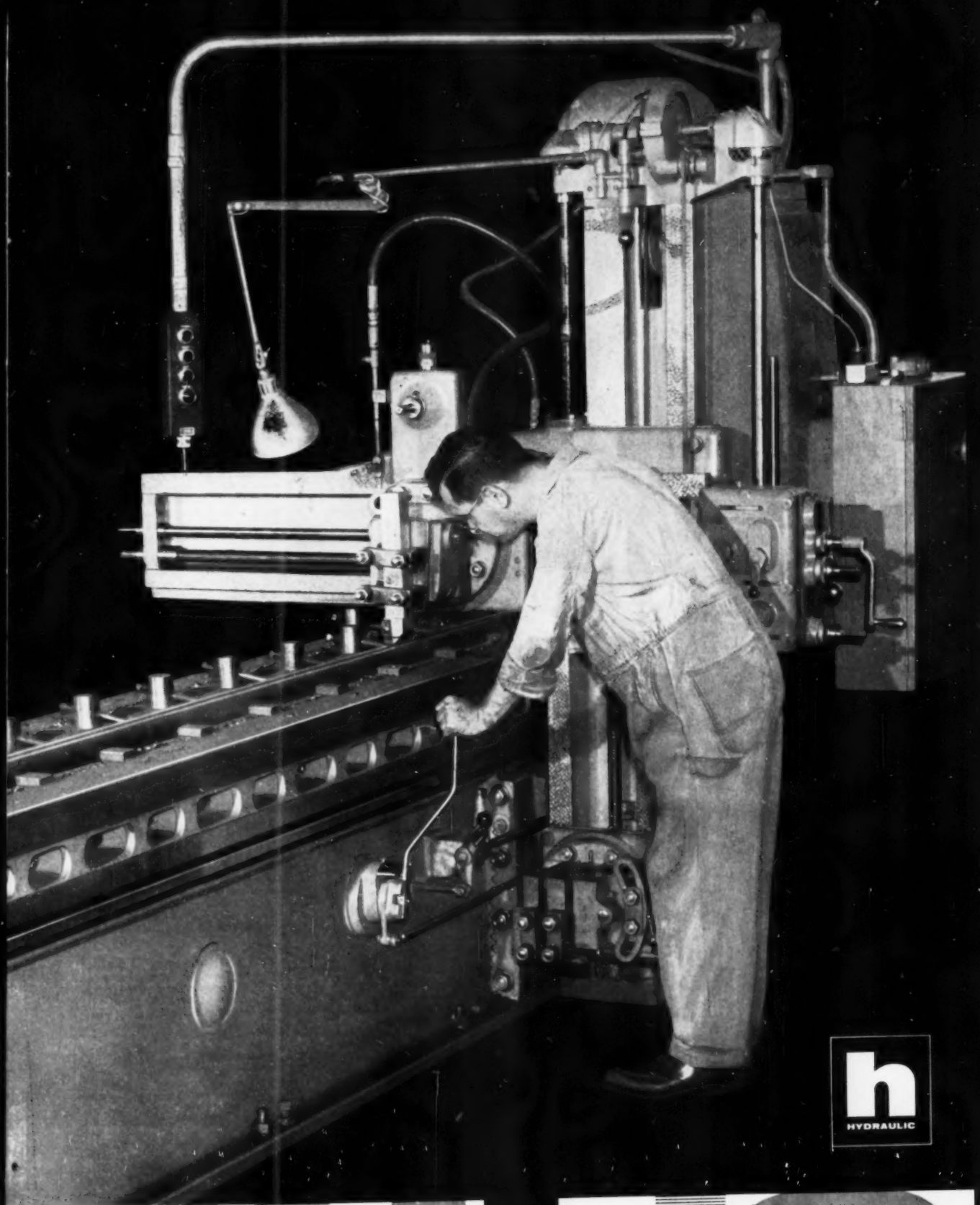

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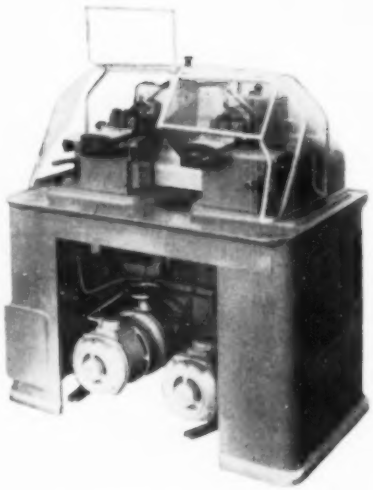
HYDRAULIC

AULIC

KUMMER
"double header"
LATHE
doubles
operator
efficiency



The *KUMMER MR 6020* is a high-precision, semi-automatic lathe, cam-controlled for *speed, accuracy and finish.* Lathe is arranged so that one person can conveniently feed the two independently operating machining heads

Unique slide and cam action allow for complicated operation combinations, such as: TURNING AND FACING, UNDERCUTTING, CHAMFERING AND CONTOUR OPERATION.

Low Cost Tooling—single point tools, pair of cams, chuck jaws.

KUMMER'S double header lathe, *designed for accuracy*, yields uniformly high precision parts.

Stepless Spindle Speed—adjustable from 410 to 3,500 rpm
Operational Cycle—6 to 360 seconds
Power for Each Spindle—1.3 H.P.
Tool Travel—Radial — 1.670"
— Axial — 0.800"

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Swiss precision with American service

Free Literature

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ble cords imbedded in neoprene molded with nylon base fabric. Suitable for load applications from sub-fractional to 600 hp with torque load range from thousands of foot pounds down to light loads in inch ounces. Drive makes possible a range of speeds from 0 to 16,000 fpm.

30 SEALS AND FASTENERS—*A P M Corp, 852 Hawthorne Ave, Yonkers, NY.* 12-page catalog 359 covers complete line of single-unit, high-pressure seals and fasteners. Lists military specifications, describes features and applications for Hexseals, Seelnkrews, Seelbolts, and Seelrivits.

31 THINLINE MOTOR—*General Electric Co, Schenectady 5, NY.* 8-page illustrated bulletin GEA-6927 describes new unit rated from 1 to 5 hp in drip-proof and totally enclosed constructions for limited space applications.

32 MINIATURE SPEED REDUCERS—*Metron Instrument Co, 432 Lincoln St, Denver 3, Colo.* 4-page bulletin 97 contains information on new Series 8 and 9 available in over 40 fixed ratios. Speeds up to 10,000 rpm and torques up to 24 oz-in. can be handled. Applications illustrated.

33 METALWORKING TAPES—*Minnesota Mining & Manufacturing Co, 900 Bush Ave, St Paul 6, Minn.* 56-page manual P-MIMR illustrates and describes Scotch brand tape applications in the industry. Sections cover tape uses for machining and finishing, electroplating, stamping and fabricating, welding, product assembling, plus information on dispensing equipment.

34 PEARLITIC MALLEABLE CASTINGS—*Malleable Research and Development Foundation, Granville 1, Ohio.* 76-page illustrated handbook discusses the material; covers castings, provides facts and figures for design and applications. Charts contain all data necessary to translate basic design needs into final pearlitic malleable specifications.

MISCELLANEOUS

35 SHEET & PLATE FABRICATION —*Kirk & Blum Manufacturing Co, Cincinnati 9, Ohio.* 40-page catalog illustrates and describes facilities for contract manufacturing in sheet and plate to ½-in. thickness as well as light structurals. More than 100 different parts and assemblies that company produces are pictured, from massive boiler breechings to smallest stampings.

36 DEEP DRAWN PARTS — *Peterson Products Corp, 4340 River Rd, Schiller Park, Ill.* 16-page brochure offers illustrated information on facilities for producing deep drawn parts and metal stampings to customer specifications. Case histories included.

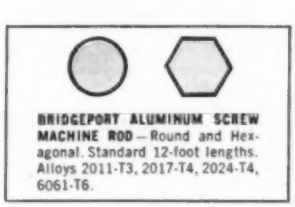
37 LEASING—*US Leasing Corp, 130 Montgomery St, San Francisco 4, Calif.* 8-page brochure explains the leasing of machinery and equipment. Describes in simplified terms how it works, advantages, what can be leased, who is eligible.

38 METAL SPINNING—*J Schrader Co, 4801 Fenwick Ave, Cleveland, Ohio.* 12-page brochure contains description of metal spinning and hydroforming facilities. Company spins parts up to 85 in. dia by ⅛-in. thick in steel, stainless, aluminum, brass, copper, Monel, etc. Parts up to 12 in. in dia and 7¾ in. deep can be hydroformed using blanks from 0.005 to ⅜ in. thick.

NOW

Get Bridgeport Aluminum Screw Machine Rod from Local Bridgeport Warehouse Stocks

For fast, quick service on your aluminum screw machine rod requirements, call your Bridgeport Warehouse. You'll get prompt delivery of these Bridgeport aluminum mill products—which are made to the same high standards for which Bridgeport is so well known. Your Bridgeport warehouse also offers expert technical service on aluminum as well as all your metals problems. Call the Bridgeport Warehouse nearest you today. Or write for our price list. Dept. 2202.



BRIDGEPORT ALUMINUM SCREW MACHINE ROD—Round and Hexagonal. Standard 12-foot lengths. Alloys 2011-T3, 2017-T4, 2024-T4, 6061-T6.

CHICAGO: LAfayette 3-2230
CLEVELAND: CEdar 1-5180
DENVER: MAin 3-0273, AComa 2-4108
ST. LOUIS: CEntral 1-0076
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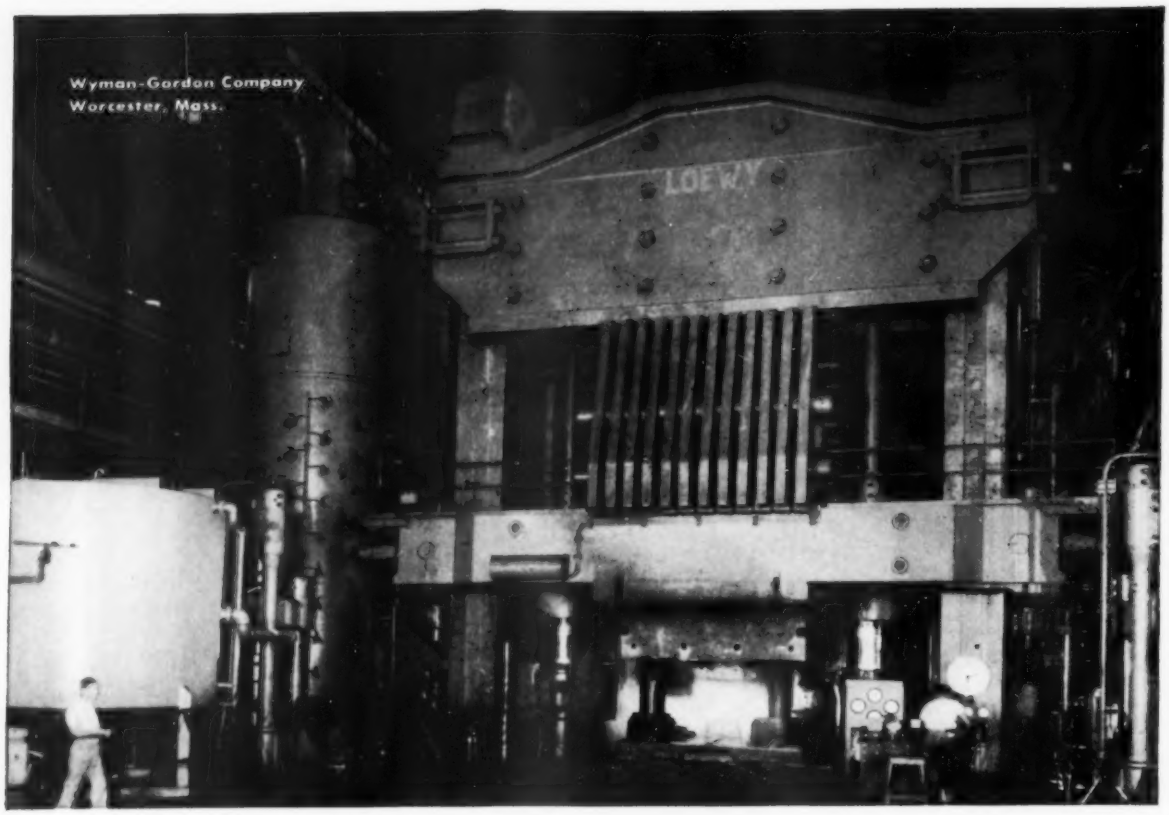
Sales Offices in Principal Cities • Fast, Dependable Service on your Brass, Copper, and Aluminum Needs
Specialists in Metals from Aluminum to Zirconium



Operation Big Squeeze:

World's largest presses lubricated by Cities Service Pacemaker Hydraulic Oils

Once a forging operation for horse-drawn carriages, Wyman-Gordon Company now operates the world's largest presses, with the newest one capable of exerting 50,000 tons pressure.

Reason for this tremendous press is the increasing need for strong, lightweight metal parts for aircraft. Today, as for many years, no military or transport aircraft takes to the air without Wyman-Gordon forgings.

With its huge, hydraulically operated presses, Wyman-Gordon is able to forge huge pieces with one big squeeze. Sometimes a whole unit for a landing-gear strut. Or one mammoth wing spar.

The press that exerts 50,000 tons pressure is described by Wyman-Gordon as "the largest single machine ever conceived"—and few people would argue the point after seeing it.

Mounted in a pit that extends nine stories beneath the earth, the giant press is over 114 feet high and weighs 10,605 tons, 6,450 of which moves up and down.

Cities Service is justifiably proud that here as in all of Wyman-Gordon's presses with 18,000 tons pressure or better, hydraulic lubrication is provided by Cities Service Pacemaker Oils.

It is hardly necessary to point out the incredible demands that such machinery makes of its hydraulic lubricants... and certainly it is self-evident that if Cities Service Pacemaker Oils can perform satisfactorily in the world's largest presses, they'll do the same for you. Talk with a nearby Cities Service Lubrication Engineer. Or write: Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y.

Entire Rig Is Operated by One Man with the few simple controls shown here. With a flick of his fingers he can put on a squeeze of 50,000 tons. Result is extremely strong lightweight forgings for aircraft.

Lubrication Foreman has mammoth responsibility. Here, he checks dispenser for Cities Service EP 20 Lubricant... used on main bed and columns of large presses and other areas subject to extreme pressures.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Torque-Arm

THE DODGE DEVELOPMENT THAT CHANGED THE NATION'S HABITS OF SPEED REDUCTION

America's Most Complete Line of Shaft Mounted Speed Reducers

55 MODELS

- 1 to 200 hp. at 100 rpm!
- Output speeds from 10 to 378 rpm!
- Single Reduction
- Double Reduction
- 5 to 1 Ratio
- 15 to 1 Ratio
- 25 to 1 Ratio
- Any speed ratio up to 150 to 1 obtainable by selection of pre-determined combination of reducer and V-belt drive.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."

In fewer than ten years, the range of Torque-Arm Shaft Mounted Speed Reducers has increased from 6 to 55 models, to meet the ever increasing demand for this improved method of speed reduction.

By eliminating foundation, sliding base and flexible coupling this modern speed reducer has saved untold installation time and untold dollars of cost.

The rugged semisteel housing developed by Dodge has never been improved upon. It is corrosion resistant—and it has the strength to hold bearing seats in line for the life of the unit.

Dodge design provides wide spacing for the bearings. Loads are carried easily, contributing to Torque-Arm's long life and very high efficiency. The gears are finest quality—helical, heat treated steel.

Torque-Arm mounts vertically or horizontally in any position around the driven shaft. It locks to the shaft on *both* sides of the housing. The holes in the output hub provide simple removal with puller. Overload release and built-in backstop are optional.

Dodge Torque-Arm is America's most widely used shaft mounted speed reducer. It is stocked by your local Dodge Distributor. Ask him. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 100 Union, Mishawaka, Ind.

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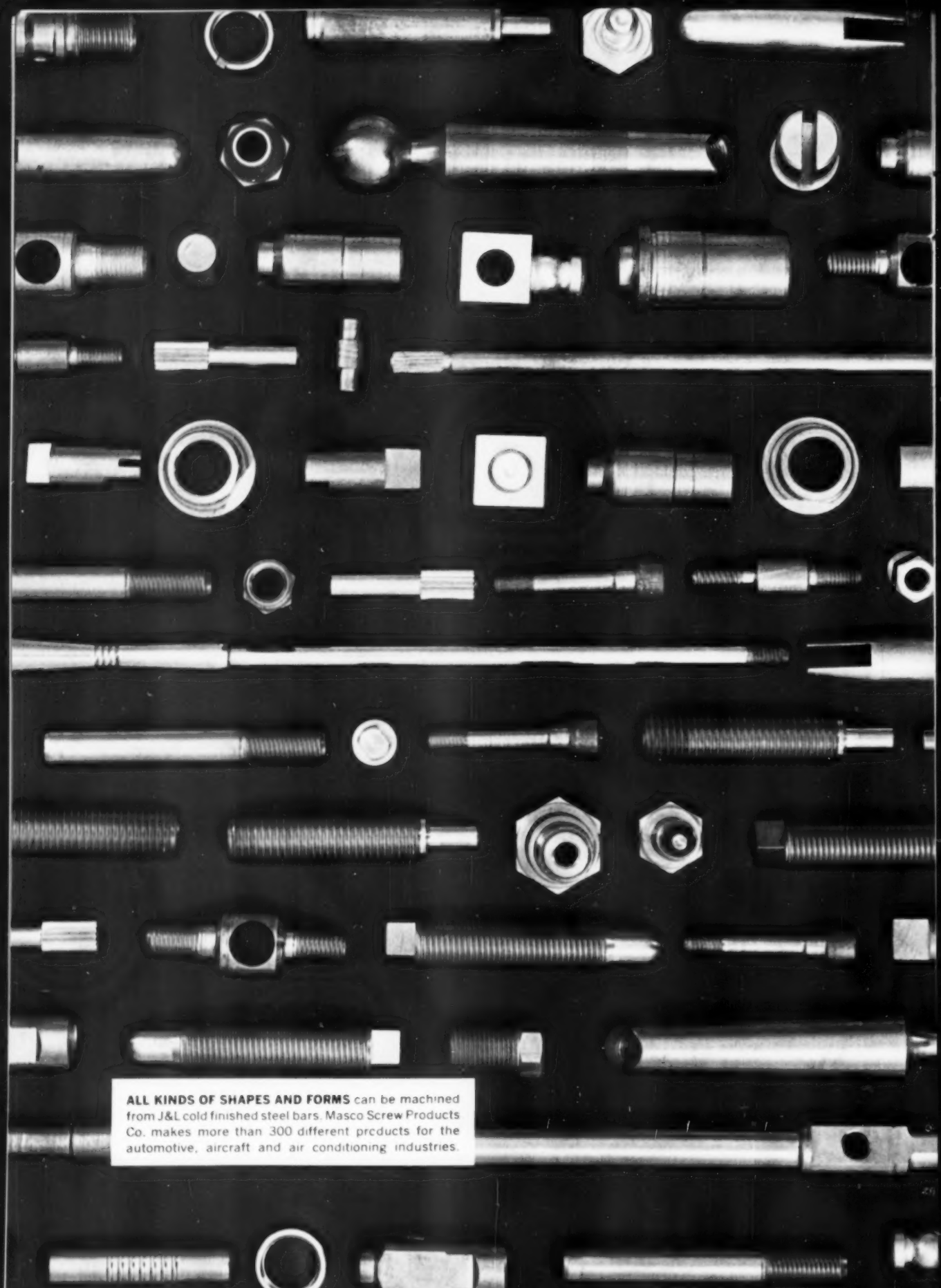
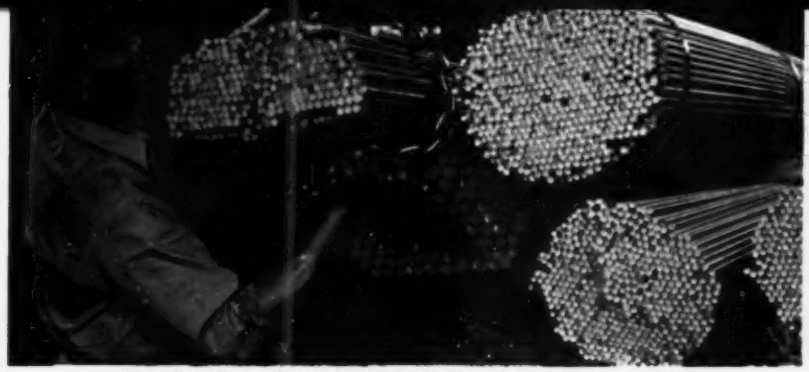
of Mishawaka, Ind.

CIRCLE 296 READER SERVICE CARD



ALL KINDS OF SHAPES AND FORMS can be machined from J&L cold finished steel bars. Masco Screw Products Co. makes more than 300 different products for the automotive, aircraft and air conditioning industries.



Detroit's Masco Screw Products Company uses round, square and hexagonal J&L leaded steel bars in sizes from ⅜" to 1⅛"

More than 96 automatic screw machines are in almost constant operation

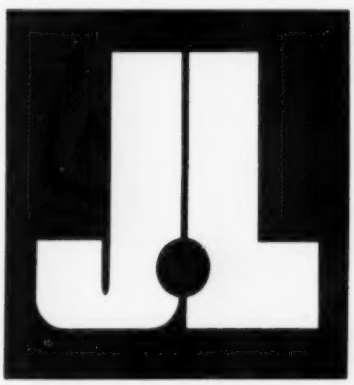
Production runs vary from less than 10,000 to more than 2,500,000 pieces

Even complex machining operations have fewer work stoppages with free machining J&L leaded steel

Parts are often so smooth after routine machining that no further finishing is necessary

Rigid Masco inspection procedures assure products of dependable quality

Masco regularly handles specifications calling for dichromate, chromium, and other protective coatings



"J&L leaded steel bars machine at maximum practicable speeds for screw machines"

. . . reports Masco Screw Products Company

"While we're seldom able to run our automatic screw machines at their maximum rated speeds, we've found that J&L leaded steel bars permit the fastest machining speeds practicable," says Alex Wood, plant engineer of Masco Screw Products Company, Detroit's largest independent manufacturer of screw machine products.

"The free machining properties of this J&L cold finished steel permit high speed production. The short length chips minimize tool edge build-up. Tool wear is reduced. And, frequently, fewer finishing operations are needed.

"This is a good steel for screw machine products."

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

Where cold rolled steels originated in 1859

Eye Accidents Cost Big Money

482A
IMPACT GOGGLE

Jumbo-size, one piece, interchangeable acetate lens. Flying particles bounce right off this .050" thick lens which meets all government requirements. Soft vinylite frame fits snugly. Very flexible for comfort. Adjustable, elastic headband. Clear frame, clear or green acetate lens. FOR GREEN FRAME, clear or green lens, specify NO. 483A.

484A
CHEMICAL GOGGLE

Note louvers which provide safe indirect but ample ventilation. This typical example of AO engineering increases comfort, reduces fogging. Mask is acid and alkali-resistant to splash. Lens similar to 482A lens. FOR GREEN FRAME, clear or green lens, specify NO. 485A.

486A WELDING GOGGLE

New nylon adapter holds lenses in frame securely and will not buckle or crack in heat. Close fitting, no dangerous, stray light rays can enter. Good ventilation and fogging control from 8 louvers. Comes with Noviweld filter lenses, shades 3, 4, 5, 6. Companion model 489A for chipping and grinding has clear frame, clear transparent adapter and Super Armorplate lenses.

AO Eye Protection like this Costs Little!

An American Optical Safety Goggle costs less than the *slightest* lost time eye accident. Just one *serious* eye accident can cost one thousand times as much — and more — in direct and indirect costs! These AO 480A Series Flexible Mask Goggles offer the following advantages:

- **Light Weight**
- **Better Ventilation**
- **Optical Fidelity**
- **Wide Angle Vision**
- **Excellent fit over personal glasses**

YOUR NEAREST AO SAFETY PRODUCTS REPRESENTATIVE CAN SUPPLY YOU

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Always insist on AO Trademarked Safety Products

Harvey L Spaunburg Jr (left), manager of the manufacturing division of Hartford Special Machinery Co, Hartford, Conn, has been appointed vice president, manufacturing. **Robert A Bode** (center), general sales manager, has been named vice president, sales. **Francis A Carr** has been promoted from production control superintendent to factory manager

NAMES IN THE NEWS...

Louis H Schuette has been named administrative vice president for all operations of Sundstrand Corp (formerly Sundstrand Machine Tool Co) Rockford, Ill. Mr Schuette, a Sundstrand director, was vice president for the company's aviation, turbo and hydraulic operations. **A H Swenson** has been promoted from manager to vice president of the hydraulic division. Both posts are newly established.

A Francis Townsend, vice president, engineering and development, of Heald Machine Co, Worcester, Mass, has been elected to the board of directors. Also elected to directorships: **Edwin J Keyes,** vice president and works manager; and **Raymond A St John,** vice president and general sales manager.

Edward D Rollert, general manager of the Buick Motor Division, has been named a vice president of General Motors. Mr Rollert became Buick general manager May 1 (*AM* —May 4, p193).

Donald E Beaton has been named director of manufacturing for Twin Disc Clutch Co's Hydraulic Division in Rockford, Ill. He has been serving as assistant general manager of the division since 1952.

Murray Wachsman, director of manufacturing for Lewyt Manufacturing Corp, Long Island City, NY, manufacturer of electronic and mechanical equipment, has been named vice president, manufacturing. **Sheldon Detwiler,** manager of electronics engineering and data processing systems, has been made vice president, research and development.

E L Kemper has been made manager of the Salt Bath Furnace Division of Lindberg Engineering Co, Chicago. He was formerly associated with the A F Holden Co, Detroit.

Robert S MacArthur has been named president and board chairman of Stocker & Yale, Inc, Marblehead, Mass, manufacturer of precision optical measuring instruments. He was formerly associated with Polaroid Corp as production manager of the camera products department.

L S Hilton has been appointed manager of the abrasive and diamond wheel departments of the Manhattan Rubber Division of Raybestos-Manhattan, Inc, Passaic, NJ. **C Fleming Jr** has been named production and development manager. Mr Hilton was formerly sales manager of the division.

Robert H Davies has been elected president of Electric Auto-Lite Co, Toledo. He succeeds **James P Falvey,** named board chairman. Mr Davies has been associated with Clark Equipment Co of Buchanan, Mich, as vice president.

Robert B Stewart has been appointed president and general manager of the American Forging & Socket Co, Pontiac, Mich, producer of metal stampings and assemblies. Formerly vice president, he succeeds **Goodloe H Rogers** who has retired. Factory Manager **James J Rath** takes over the vice presidency.

William H Smith, formerly manufacturing manager, has been appointed plant manager for Ford Motor Co's Indianapolis Steering Gear and Cold Heading Plant, Transmission and Chassis Division. He succeeds **R T Thornton,** promoted to general manufacturing manager for the Hardware and Accessories Division, Rawsonville, Mich.

Arthur E Gilman has been elected president of the Bay State Abrasive Products Co, Westboro, Mass. He will continue as treasurer of the firm.

Dr Gordon S Brown has been appointed dean of the School of Engineering at MIT. For the past seven years Dr Brown has headed the department of electrical engineering and is internationally known for his contributions in research and leadership in the field of automatic control systems.

OBITUARY

Paul A Montanus, 76, president of the Springfield Machine Tool Co, Springfield, Ohio, died April 21. Son of the founder of the company, he had headed the organization since 1947

3 ways CDT can help you

CDT CAN INCREASE YOUR PRODUCTION
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

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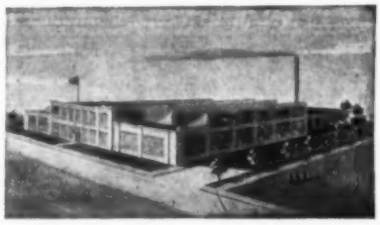
Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



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ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

NAMES IN THE NEWS...

Richard E Reich has been appointed vice president, sales, Proto Tool Co, Los Angeles. He moves up from the post of product sales manager.

Lawrence A Zwicker has been appointed general manager of GM's Harrison Radiator Division, Lockport, NY. Formerly director of engineering and sales, he succeeds Edward D Rollert, named general manager of the Buick Motor Division at Flint, Mich. (*AM*—May 4, '59, P193).

Richard T Thornton has been named general manufacturing manager of Ford Motor Co's Hardware and Accessories Division. Formerly manager of the Indianapolis steering gear plant, he succeeds **Paul A Miller** who has resigned.

Robert A Heath has been appointed manager of engineering of Warner Electric Brake & Clutch Co, Beloit, Wis. He was formerly associated with Walker Manufacturing Co of Jackson, Mich, as chief engineer.

Russell B Malloy has been made vice president sales and **Joseph F Taylor** assistant vice president of Maurey Manufacturing Co, Chicago. Mr Malloy has served as sales manager for all Maurey divisions for the past six years. Mr Taylor has been associated with Goodyear Tire & Rubber Co as director of V-belt sales.

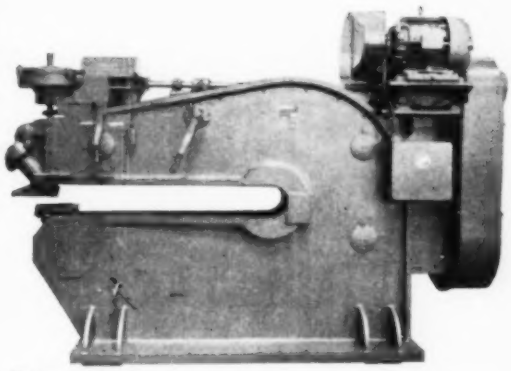
Donald O'Reilly has been made sales manager of the machine tool and attachment subsidiary of Jarvis Corp, Middletown, Conn.

Paul A Mongerson has been promoted from factory manager to vice president of Chicago Screw Co, Bellwood, Ill. **W Dean Gwin**, assistant factory manager, succeeds Mr Mongerson.

William J Parmley has been named works manager of the Kenton, Ohio, plant of Hooker Chemical Corp's Durez Plastics Division. He was plant superintendent prior to the appointment.

Howard K Norris has been named production manager of the mechanical goods division of US Rubber Co, New York. Formerly administrative assistant to the factory manager at the company's Passaic plant, he succeeds **W A Armstrong**, who has retired.

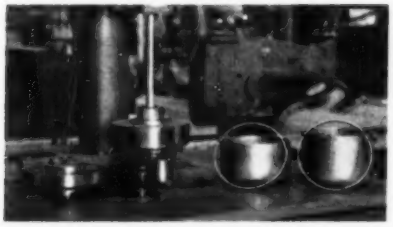
New Additions To The BEATTY Line of Metalworking Equipment



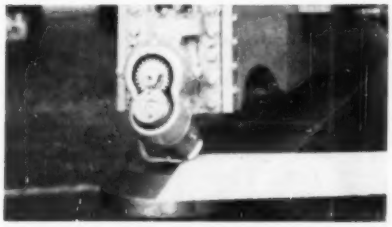
Rotary Shear

Stamping Trimmer

BEATTY-QUICKWORK



Beatty-Quickwork trimmer trims flash from almost any kind of stamping in a single plane.



Beatty-Quickwork rotary shear cuts, bevels, circles, flanges and joggles plate and sheet metal up to 1" mild steel.

ROTARY SHEARS and STAMPING TRIMMERS

QUICKWORK — leading name in precision machine tools — Rotary Shears and Stamping Trimmers — is now a part of the famous BEATTY family of metalworking equipment. This new acquisition (from the Whiting Corporation, Harvey, Ill.) is an important step in bringing you a more complete line of cost-saving, high-production metalworking equipment from one reliable source — BEATTY. The BEATTY-QUICKWORK Rotary Shears and Stamping Trimmers are distributed through Quickwork and Beatty dealers. We invite your inquiry concerning Beatty-Quickwork and other Beatty equipment — presses, punches, shears and bulldozers — which can help you cut costs; solve your metalworking problems economically, faster and with the precision for which Beatty and Quickwork are well known.

BEATTY-QUICKWORK

Division of BEATTY MACHINE & MFG. CO.

948 150th St., Hammond, Indiana

CIRCLE 302 READER SERVICE CARD

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Bristol's the Capital of This OLD Industrial Country

If you choose a plant site in Bristol you don't have to worry about the pioneering aspect of most moves South. Bristol is an old industrial center — has been for 50 years!

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Bristol
INDUSTRIAL DEVELOPMENT BOARD
of the Twin Cities of
BRISTOL • TENN. - VA.

NAMES IN THE NEWS...

Owen C Davis, treasurer, has been elected vice president and treasurer of Vickers Inc, Detroit.

August Sunnen has been named to succeed his late father, **Gus Sunnen,** as general manager of Sunnen Products Ltd, Chatham, Ontario. A nephew of Joe Sunnen, founder and president of the Sunnen Products Co, St Louis, he served as general sales manager there. For the past five years he has been vice president of Ramsden Mfg Ltd, a permanent mold aluminum foundry in London, Ontario.

R M Bergeson has been appointed manager of the new field engineering office recently opened in San Francisco by Lord Manufacturing Co, five years he has been vice presi- systems for vibration and shock control. He was formerly a member of the Los Angeles staff.

John C Beach has joined Taller & Cooper Inc, Brooklyn subsidiary of American Electronics, as vice president and general manager. He was formerly vice president, operations, at Hall-Scott, Inc, California.

Royal A Stone has joined Rolock Inc, Fairfield, Conn, manufacturer of specialized alloy process and heat-treating equipment. He will head a new process equipment division concentrating on special engineering. Mr Stone was formerly division project manager at Kennecott-Titanium.

Milton Stratton has been named director of the new quality control division at GM's AC Spark Plug Division. He was formerly chief inspector for AC-Milwaukee.

Sheldon K Howard has been named Diesel Division manager of Fairbanks, Morse & Co to succeed **Carroll E Dietle** who has resigned.

Boyd P Doty, Jr, has been appointed general sales manager for American Steel & Wire Division of US Steel Corp. Formerly Cleveland district sales manager for the parent company, he succeeds **Howard B Maguire** who has retired.

William H Jackson has been elected vice president, sales, of Diamond Power Specialty Corp, Lancaster, Ohio. He was previously assistant marketing manager of Babcock & Wilcox Co's Boiler Division.

on the spot

A FAST, ACCURATE GAGE— WHERE AND WHEN YOU NEED IT!

The MICROtrol* 170 is a transistorized gaging system for use at the machine, in the gage laboratory or on the production line. Production personnel find it simple to use. The four types of gage heads available can be used interchangeably with the battery-powered amplifier.

Features

- *Only 2 control knobs*
- *One adjustment zeros both scales*
- *Large meter with 4.6" scale*
- *Dual range—from either ± .0003" to ± .003" or ± .001" to ± .010"*
- *Accurate—transistorized throughout*
- *Pocket-sized—5¾" square by 3 1/16"*
- *Mounting adapters and gage head stored in cover*
- *Carrying case handle doubles as amplifier stand*
- *Lightweight—weighs only 3 lbs.*
- *Battery powered—can be used anywhere*
- *AA dry cells can be used in emergency*
- *Gage heads interchange quickly and easily*

Basic System, complete with gage head and amplifier... only $340.00

*Trade Mark

Contact your nearest Cutler-Hammer office or—Order Direct from

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CIRCLE 304 READER SERVICE CARD

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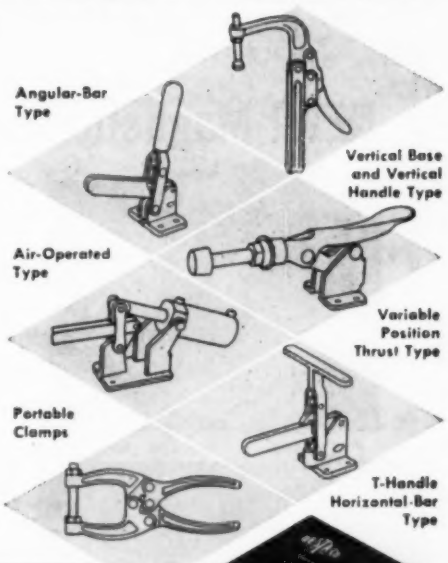
Where It's Quality, Quality, Quality!
It's Quality DE-STA-CO Toggle Clamps

FINAL INSPECTION OF ROSS OPERATING VALVES subjects every valve to a pressure test far exceeding its normal usage. For over fifteen years, fixtures similar to this, all employing De-Sta-Co No. 620 plunger clamps, have been built to do this critical high pressure sealing job.

Whether your holding and clamping operation is inspection, machining, tapping, grinding, welding, bonding or other assembly, there is a specific De-Sta-Co Toggle Clamp to do it better. Fast action, positive clamping, long life through thousands of production operations have made De-Sta-Co known for almost 30 years as the leading tool in the field. And all of our medium and larger models use hardened serrated pins in hardened bushings staked to prevent wear. A broad selection of spindle accessories increases the versatility of the clamp you specify.

Our representative in your area is qualified and ready to serve you. Send for our catalog showing clamp applications, scale drawings and complete information.



DE-STA-CO

ORIGINATORS OF PRODUCTION CLAMPING

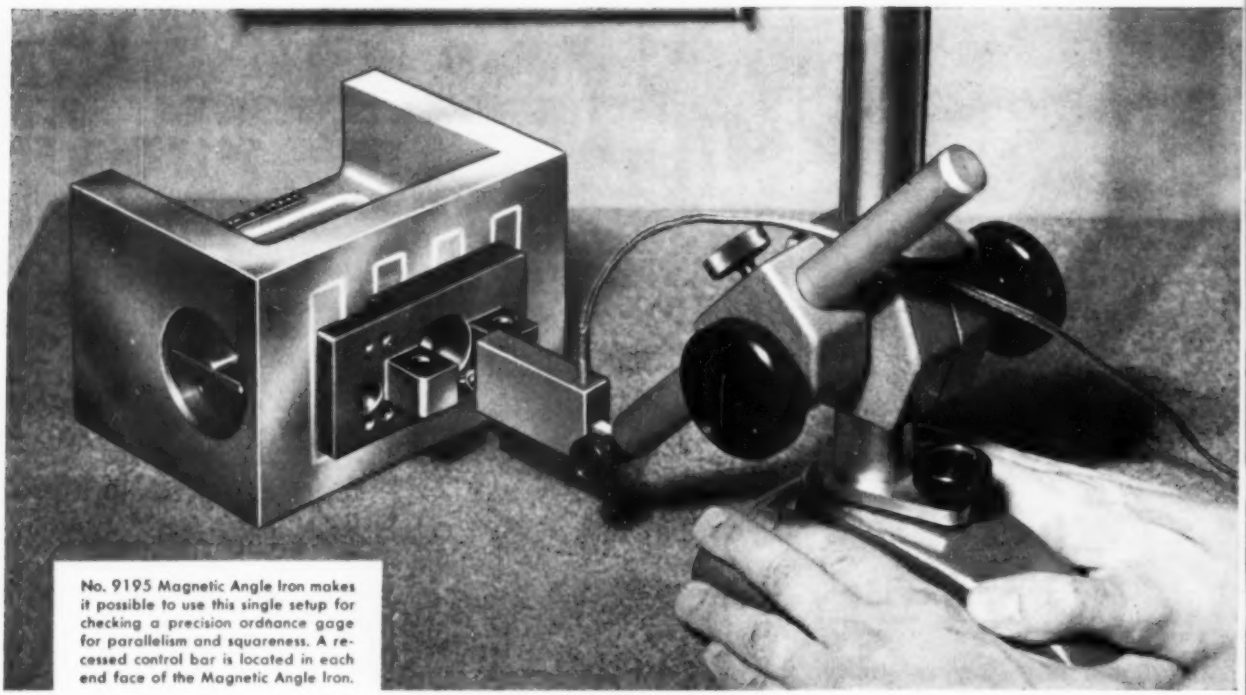
De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.

DETROIT STAMPING COMPANY

343 MIDLAND AVENUE • DETROIT 3, MICHIGAN •

FROM THE TAFT-PEIRCE METALWORKING FAMILY

10 Tools that can Simplify



No. 9195 Magnetic Angle Iron makes it possible to use this single setup for checking a precision ordnance gage for parallelism and squareness. A recessed control bar is located in each end face of the Magnetic Angle Iron.

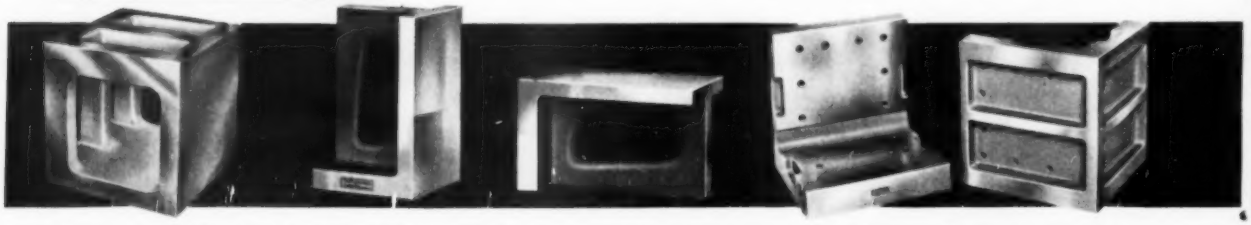
NEW! Magnetic Angle Iron holds work without clamping

Here's another ingenious layout and inspection shortcut now available from Taft-Peirce! It's a universal right angle iron and magnetic chuck combined to eliminate the lost time and inconvenience of work clamping and multiple setups.

Work is held firmly in place by energizing the faceplate with a 90° turn of a control bar, recessed into each end face. By turning this control bar through a small portion of its span, the face can be slightly magnetized so that the work may be easily adjusted by hand to final location before full holding power is applied.

The Magnetic Angle Iron can be turned on its side, back, or ends for checking work in different positions, and a heavy rib gives structural strength and serves as a carrying handle. Faces, sides and ends are precision ground square and parallel within .0002".

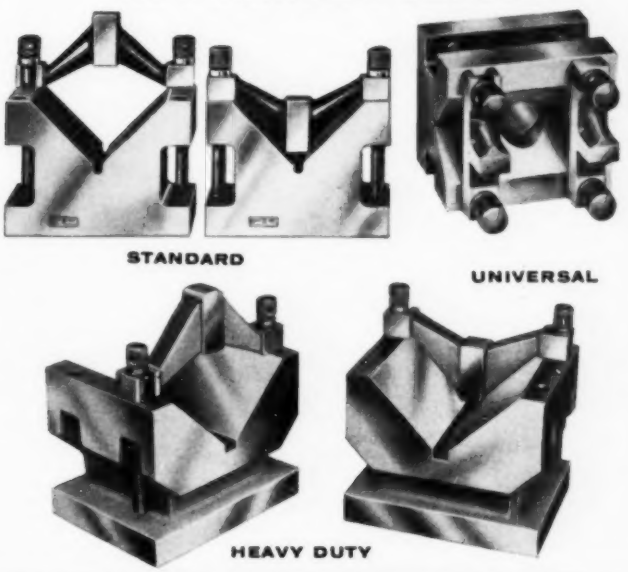
Taft-Peirce Magnetic Angle Iron can help save time and money wherever there's setup work being done. Order from your Taft-Peirce Representative, or direct.



There's a Taft-Peirce Angle Iron to simplify every setup. Box Angle Iron combines right angle iron and box parallel into one tool. Sides are open for clamping, and nesting. Can be used as a base for special fixtures. Extremely versatile. **Universal Right Angle Irons** provide accurate squareness and parallelism for clamping to any face and can be used in many positions without relocating work. Can be set on side or end for use as reference block on large work. **Pallet Irons** are multi-purpose workholding fixtures for making all types of setups. Ideal for locating and clamping work to travel through transfer operations. Provided with tapped holes and recessed ledges. Held to close tolerances for squareness, parallelism and base-to-face height.

Setups and Inspection

TAFT-PEIRCE V-BLOCKS



The complete line of Taft-Peirce V-Blocks provides a quick, positive means for holding work for all types of layout, machining, and inspection.

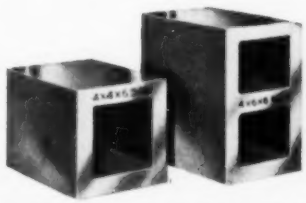
Standard Series has reversible steel clamps which produce true tangential contact on cylindrical work. Three sizes available for holding work up to 3" diameter — all furnished in matched pairs.

Universal V-Blocks have an accurately located hole in the center of the "V" by which each block can be positioned quickly and accurately for any setup. Also provides clearance for drilling and boring.

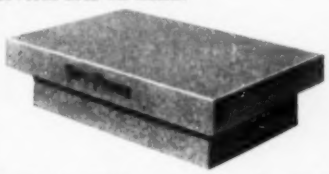
Heavy Duty V-Blocks provide workholding capacity up to 3¾" diameter. They have an unusually heavy body design for positive rigidity and accuracy, and an all-around base ledge for clamping.

NEW PRODUCTION AND INSPECTION EQUIPMENT CATALOG NOW READY! Be sure and get all the latest information on precision tools and workholding devices. Contains 34 pages of data, information and illustrations. Send for your copy, today.

Precision Tools Every Shop Can Use to Save Money



Box Parallels are useful as "building blocks" for setting up work on machine tables or as a quick mounting for surface plate layout and inspection. Can be used in pairs because of close manufacturing tolerances. Ideal for special fixture bases. Keep several sets on hand.



Surface Plates provide the most accurate reference surfaces available today . . . your foundation for all layout and inspection work. Cast iron or granite in a complete selection of sizes and surface accuracies.

Versachek Electronic Gage provides a new accuracy standard for inspection work. Size variations down to .00001" are quickly detected by frictionless pickup head. Four switch-selected magnifications, exclusive self-calibration, and portability are special features. Fully described in Catalog No. 511.

TAKE IT TO TAFT-PEIRCE

TP 9-2

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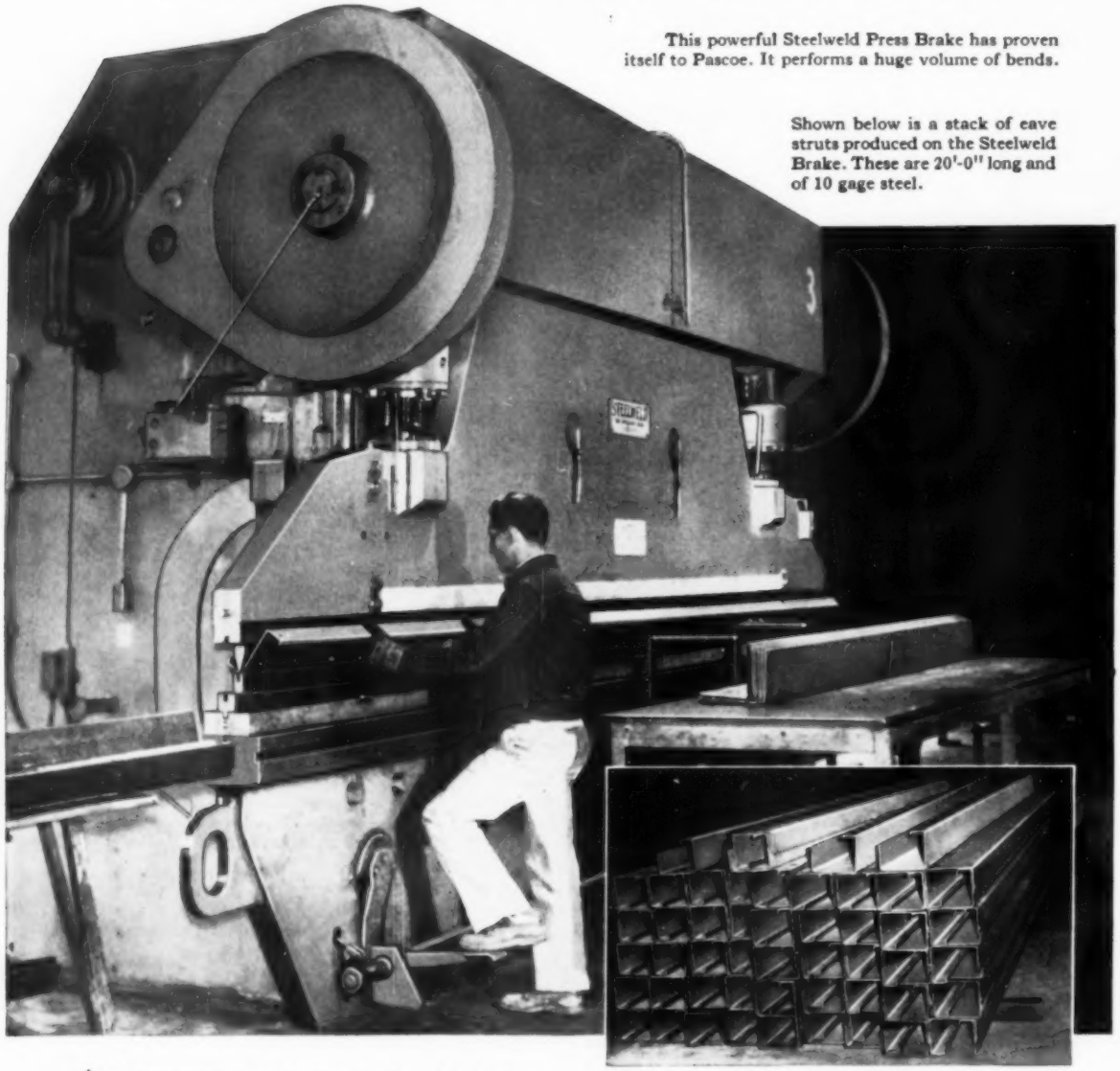
STEELWELD BRAKE

AIDS PASCOE BUILDING PRODUCTION

This powerful Steelweld Press Brake has proven itself to Pascoe. It performs a huge volume of bends.

Shown below is a stack of eave struts produced on the Steelweld Brake. These are 20'-0" long and of 10 gage steel.



AN important manufacturer of prefabricated steel buildings on the West Coast, the Pascoe Steel Corporation, Pomona, California, keeps their Steelweld Press Brake going full tilt in order to keep up with the production schedule.

The brake normally handles steel up to 20'-0" x 3/16", although occasionally 1/4" metal is formed. It has the speed and power to produce sharp accurate bends at a fast rate.

Despite all the work put through, only the meagerest amount of maintenance is required. For instance, the clutch has had to be adjusted only once, every eight-month period and this can be done in very few minutes.

Pascoe builds a complete line of pre-engineered buildings which are used for warehouses, light manufacturing, grain storage, auditoriums, aircraft hangers, etc.

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STEELWELD

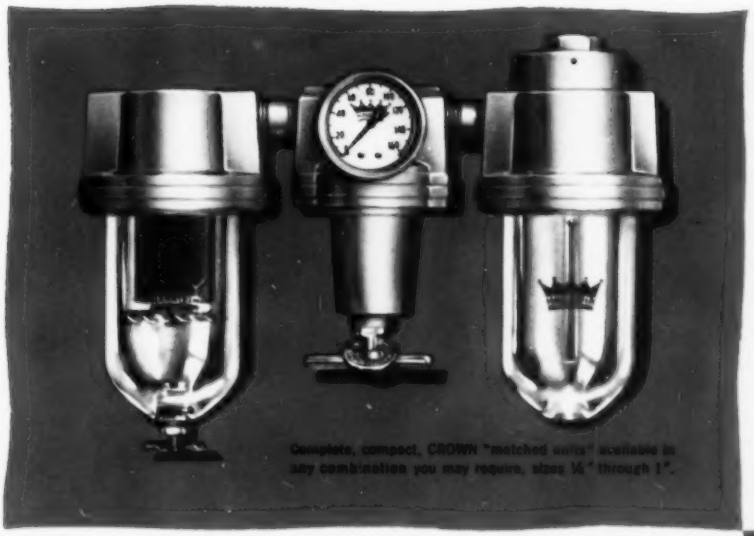
Mechanical and Hydraulic

PRESS BRAKES

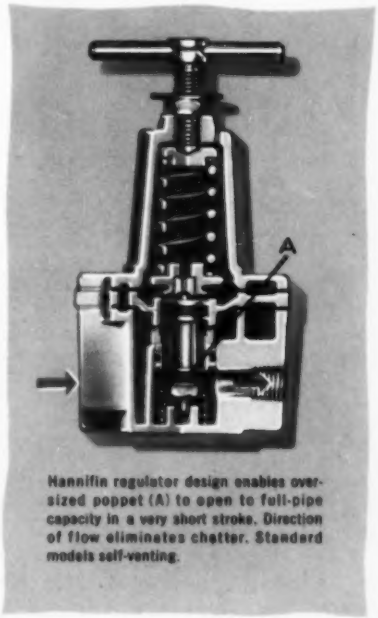
Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING COMPANY • 1473 EAST 281st STREET • WICKLIFFE, OHIO

Crown From HANNIFIN air preparation units that don't waste air power



Complete, compact, CROWN "matched units" available in any combination you may require, sizes ¼" through 1".



Hannifin regulator design enables oversized poppet (A) to open to full-pipe capacity in a very short stroke. Direction of flow eliminates chatter. Standard models self-venting.

Hannifin CROWN "Combo" units – filters, regulators and lubricators in any combination – keep compressed air in the "pink of condition" without depriving you of needed air flow.

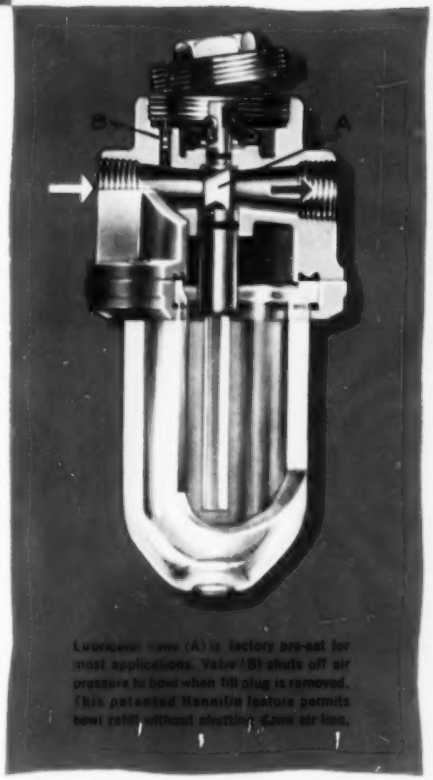
Crown regulators open fast on demand, close precisely when demand is satisfied, deliver the exact amount of air needed. Their "piston balanced" poppet design, which makes possible a flat, large-area, poppet-type valve with very short stroke, is the reason. The inherent stability of this design – no hunting or chatter – results in multi-million cycle life.

Crown filters have large, reusable filter elements for minimum resistance to air flow. Crown lubricators introduce predetermined amounts of oil into the air stream, automatically. Their design is so responsive to variations in air flow rate that the concealed, tamperproof adjustment is rarely used. This is the easiest lubricator of all to fill, and remote-fill models are available.

Crown units are competitively priced and stocked in principal industrial areas by Hannifin CROWN authorized distributors. For CROWN literature and the name of the distributor nearest you, write:

HANNIFIN COMPANY

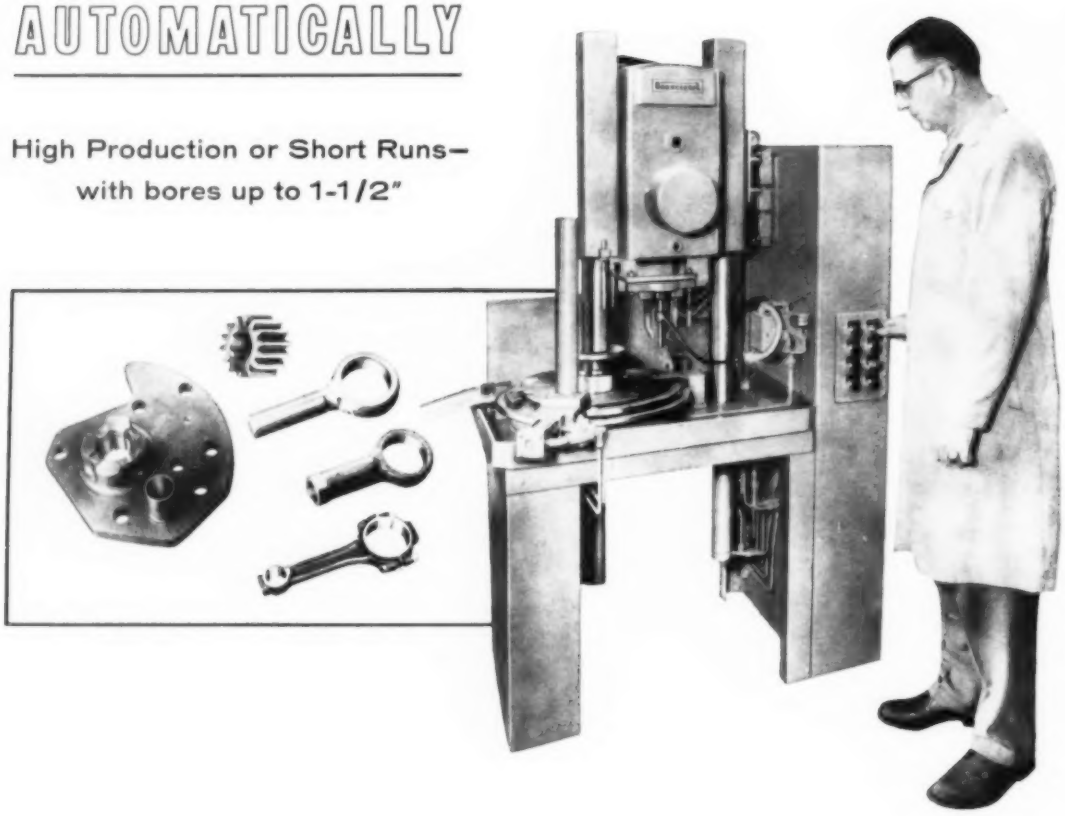
535 South Wolf Road • Des Plaines, Illinois



Lubricator valve (A) is factory pre-set for most applications. Valve (B) shuts off air pressure to bowl when fill plug is removed. This patented Hannifin feature permits bowl refill without shutting down air line.

HONE SMALL PARTS
AUTOMATICALLY

High Production or Short Runs—
with bores up to 1-1/2"



This new No. 10 series of Single Spindle Vertical Honing Machines is designed with complete automation for handling small parts with bores up to 1½". These machines are small and compact in size, highly accurate, and simple to operate. They are particularly efficient and economical for honing short production runs, as well as sustained high production work.

Design features include pneumatic hone expansion with automatic rapid expansion, feed and collapse of stones; automatic bore-to-bore sizing; magazine loading and automatic ejection. Automatic shut-down is also provided as honing stones become worn. Optionally, parts may also be automatically pre-gauged, honed, post-gauged, sorted and ejected.

Powered by an all mechanical system, these machines require very little maintenance. Rigidity and accuracy are assured through suspension of the reciprocating head between two columns.

For free estimates and complete information on application to your high-production small-part finishing operations, send blueprints to BarnesdriL engineers.

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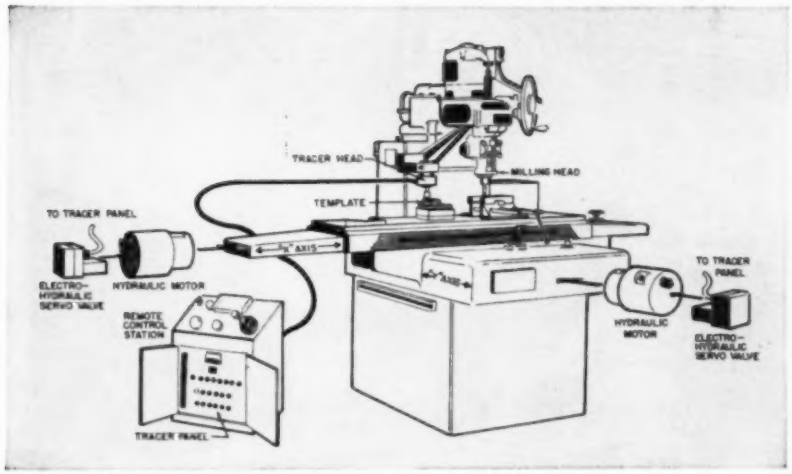
DETROIT OFFICE: 13121 Puritan Avenue

for modern, efficient
machine control . . .

Honeywell's new Electro-Hydraulic Servo Systems and Components



360° electro hydraulic tracer control system

Tracer control systems—fast, accurate and reliable system response for smooth application of large increments of hydraulic power. The flexibility, remote control and intelligence of electronics are coupled with the power and "tight" actuation of hydraulics.

Speed control systems—speed ranges of 1000 to 1, speed regulation to 0.1%, and consistent speeds to 1 rpm are possible with electro-hydraulic speed control.

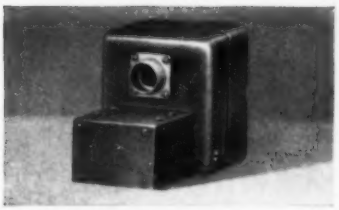
Position control systems—positioning of cylinders or motors to the most exacting specifications.

Speed and position—synchronization and programming—control of tension, force, level, torque, etc.

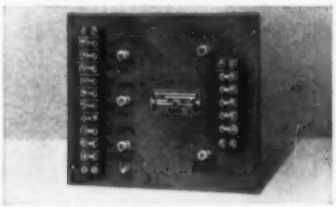
For further information on Honeywell's new machine control systems and components, and their application to your specific job, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department AM-6-12, Minneapolis 8, Minnesota.

Honeywell

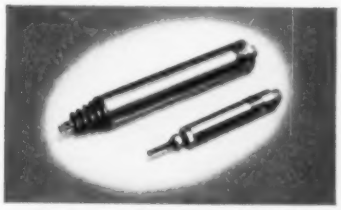
H First in Control



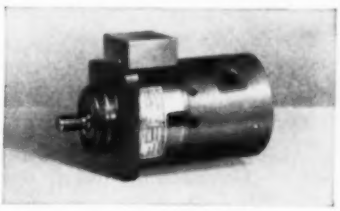
Electro-hydraulic servo valves—2-, 3- and 4-way valves with output flow proportional to input signal. Designed specifically for industrial use.



Transisterized servo amplifiers—proportional and integrating low voltage amplifiers designed for servo systems, incorporating servo valves, d-c relay and servo motors.



Feedback transducers—industrialized linear and rotary transducers providing accurate sensing and feedback for servo loops.



Hydraulic motors—roll-vane motors producing high torques at low speeds. Often connected directly to load. Integral tachometer optional.

Servo accessories—input commands, meters, manifolds, phase conversion panels, consoles, etc., to complement the servo control systems.

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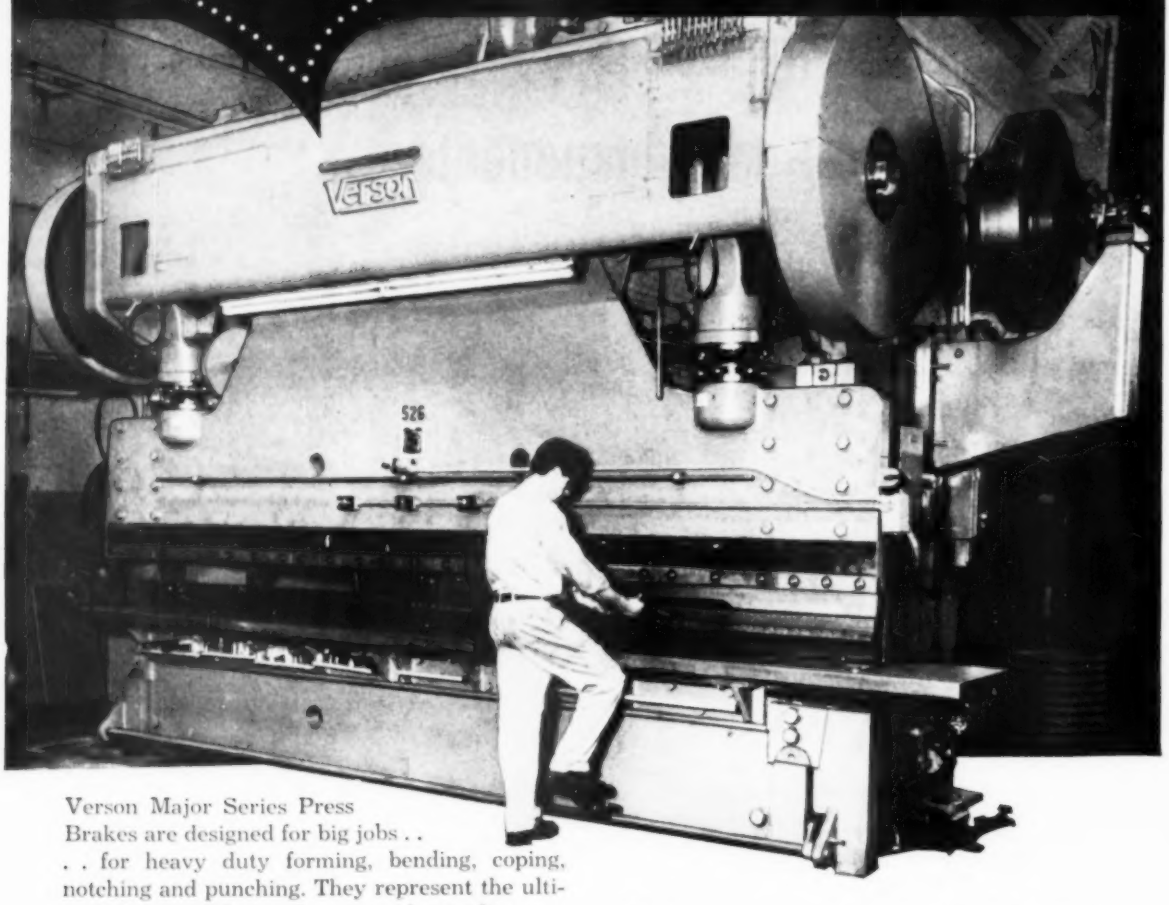

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One Battle We're Losing —And Why

Lest it seem self-serving, we of McGraw-Hill, as publishers, have hesitated to make the following statement about the "Battle of the Books." However, our reticence has been overcome by our conviction that it is greatly in the national interest to have much wider public understanding of the nature of this battle. This conviction is strengthened by the fact that many, not in the publishing industry, believe in the importance of this battle and, further, by the fact that it is a battle which the United States is losing.

The United States is losing an important battle — a battle of knowledge and ideas, waged with books. It does not have the excitement of competition in scientific achievement, nor the urgency of a diplomatic crisis, nor the obvious economic significance of a struggle for export markets. But our success or failure in this battle of knowledge and ideas may well have a decisive bearing on these more spectacular aspects of international rivalry.

The Russians know this. About a decade ago, they started a program to build up their export of books, the most durable and penetrating way of communicating knowledge and ideas. **By 1957 the Soviet Union was exporting 30 million books, one-and-a half times as many as the United States.** Many of these books are printed in English, and all are in languages of the non-Communist world.

In the languages of the Near East alone, the Russians printed and distributed 413,600 books in 1957, as compared with 166,415 in 1956. In India, Russian textbooks on engineering are to be published in English under a technical aid agreement signed in Moscow last December.

"Trade Follows The Book"

Books are in the advance guard of the Soviet political and economic challenge to the free world. With books go ways of thinking — about government, about education, about management, about science and technology. If these books do their job effectively in the training of those who will become a nation's leaders, they will provide the basis for political and cultural understanding and also, in the future, for trade.

The Russians are not the first to discover this relationship. Britain, which lives by trade, has traditionally exported more of its book production than any other nation. Today it exports one book in every two produced. The British have a favorite dictum: "Trade follows the book." They have proved its accuracy. Now the Russians are trying to make this same principle serve their purposes.

Where does the United States stand in this competition for men's minds? In number of books, it trails far behind the Soviet Union — exporting roughly 20 million books, against the Russians' 30 million. As a proportion of our total output of books, our exports amount to only 10% — against Britain's 50%.

The Russians' Advantage

U.S. book exports have grown in the years since World War II, from approximately $11,000,000 in 1946 to $35,000,000 in 1958 (both figures excluding Canada). But in expanding book exports, the American publishing industry faces two major obstacles:

(1) **The comparatively high cost of producing a book in the United States,** which puts its price well beyond the reach of many students, teachers and businessmen in other countries; and

(2) **The shortage of dollar exchange in many countries,** which means that importers can pay for

books only in currencies that are of little use to American publishers.

The Russians have neither of these problems. Soviet publishing is state-subsidized, and exported books are sold for nominal sums paid in the currencies of the importers. As these books serve the political and economic purposes of the Soviet Union, they are cheerfully sold on giveaway terms.

The American publishing industry, on its own, is making vigorous efforts to increase the distribution of American books in other countries. Leading U.S. publishers and their agents have offices and salesmen in the major countries of Asia, Africa and Latin America. Several publishers have begun to reprint textbooks in Asia at one-half to one-third of their U.S. costs, thus making them available to the students in Asian countries at prices they can more nearly afford. And the American paperback has become a symbol of low cost in popular books. But neither of these devices is practicable for serious cultural, technical, scientific, educational and professional books, which require durable, hard-bound and necessarily expensive editions. Despite their great importance to those who need these books, the demand for them is simply not large enough to warrant low-cost publishing methods.

Government agencies also have increased the availability of American books. The United States Information Agency and the International Cooperation Administration have placed American books in libraries overseas, donated them to educational institutions and presented them to key individuals in the industries and governments of the developing countries of the world. But these programs are small in relation to the need.

A Modest Program

An unusual and little-publicized Government program has helped American publishers overcome the other major obstacle to the export of books — the shortage of dollar exchange. This is the Informational Media Guaranty (IMG) program, administered by the United States Information Agency. It enables publishers of books judged to be worthy of the American way of life to sell their books, for local currency, in countries such as the Philippines, Formosa, Vietnam, Burma, Indonesia, Pakistan, Turkey, Israel, Poland, Yugoslavia, Spain and Chile, which would otherwise be unable to buy these books because of their shortage of U.S. dollar exchange.

The IMG program is not a giveaway. Publishers have to **sell** their books, and customers overseas have to want them enough to **buy** them at full prices. IMG merely guarantees that the exporting publisher receives in dollars the payments he collects from his customers in their currency. The program costs very little in terms of our total foreign aid program, or in terms of what it accomplishes. In ten years it has made possible the sale of $150 million worth of books, magazines and films to countries of key economic and strategic importance at a cost of only $10 million.

The IMG functions through a revolving fund. Foreign currencies are exchanged for dollars, and the foreign currencies in turn are resold to replenish the supply of dollars. The net cost is the small but unavoidable loss on resale of these foreign currencies. Over the ten years of this program, the IMG revolving fund has shrunk from its original $28 million to $18 million, $10 million of which is in unconverted foreign currencies.

If this modest but vitally important program is to be continued, Congress must appropriate the money necessary to rebuild the revolving fund. This would ensure that any country approved by the State Department and willing to sign an agreement to buy American books, at their full price, with its own currency, could do so. Last August, Congress reduced a requested appropriation for this purpose from $7 million to $2½ million. To continue even at its present reduced level, an appropriation of $3½ million is needed. To realize the full potential of IMG, the revolving fund must be restored to its original level.

If the IMG program is not continued, with adequate financial support, some countries whose friendship and understanding we seek today and with whom we hope to build a trading partnership in the future will have to reduce their purchases of American books to a trickle. These are countries where school teachers, college professors, students, engineers, doctors and businessmen need and want to buy American books. The loss will be not only theirs, but ours as well. For it will deprive the U.S. of one of its most effective, and least costly, means of communicating knowledge and ideas and understanding of the American way of life.

This message is presented by the McGraw-Hill Publishing Company to help increase public knowledge and understanding of an important national problem. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

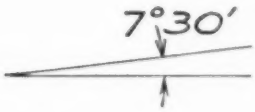
McGRAW-HILL PUBLISHING COMPANY, INC.

This is a knock-out cavity bushing.

It is used in plastic injection molding.

It is manufactured by *FASTEX,*

Division of Illinois Tool Works, Des Plaines, Illinois.

It has a 

internal taper.

It is ground from hardened tool steel, 58-60 Rockwell C

The tolerances must be held to 0.0002"

The grinder on which this bushing and all its cousins are made is a

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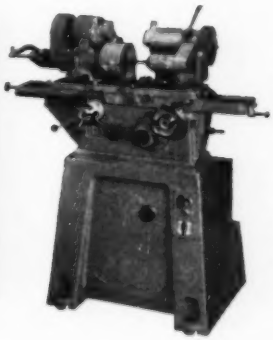
MODEL 84



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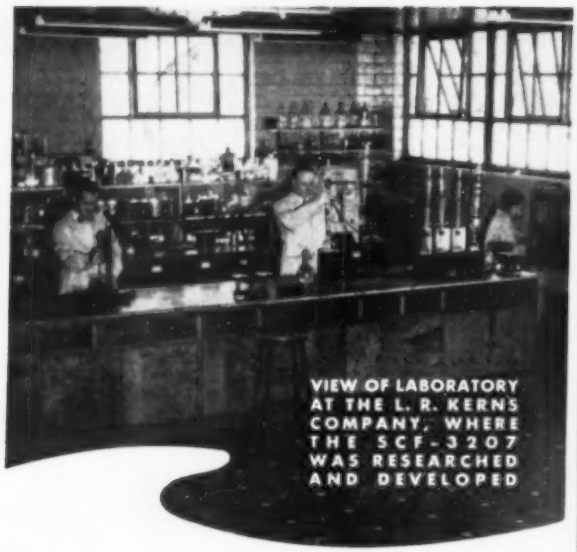

VIEW OF LABORATORY AT THE L. R. KERNS COMPANY, WHERE THE SCF-3207 WAS RESEARCHED AND DEVELOPED

New Soluble Cutting Fluid replaces straight cutting oils

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Kerns' new SCF-3207 is the result of 11 years of extensive research and development. It's the greatest advancement in cutting fluids in the last fifty years and is designed to replace cutting oils in up to 90% of all types of machining operations. SCF-3207 is a water emulsifiable, heavy duty, cutting oil base containing high percentages of extreme pressure and anti-weld additives.

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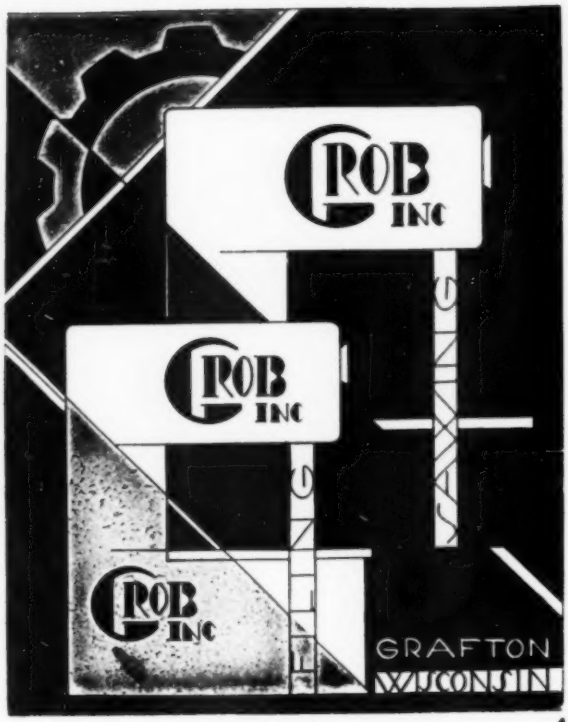

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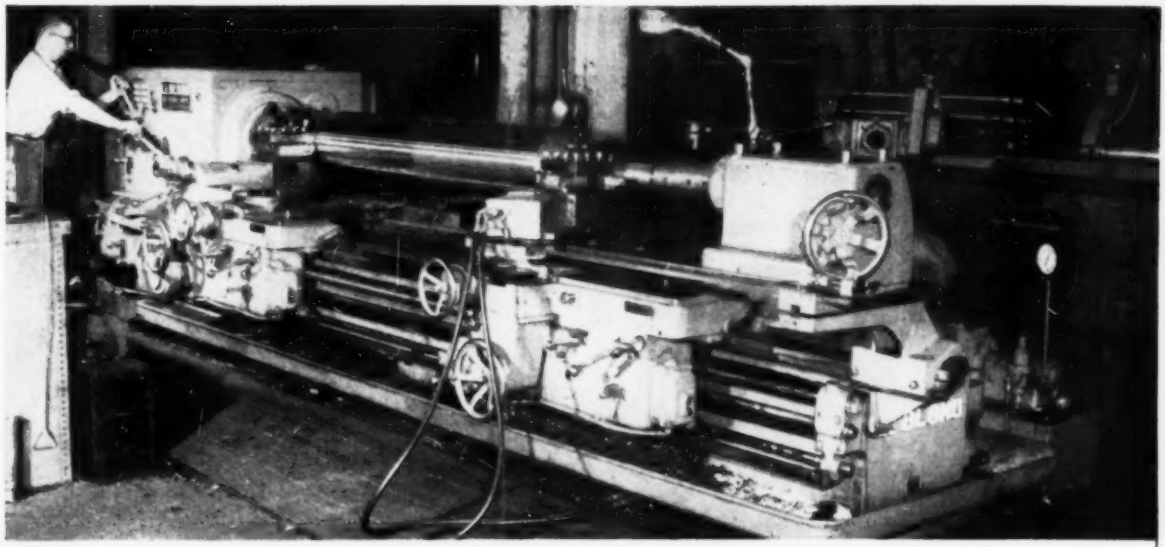


"We refuse to sacrifice half our machine capacity to save pennies on tool costs"

. . . so says a Tool Engineer of a progressive company that increased speeds and feeds on a new 50-hp heavy-duty LeBlond tracer lathe to reduce tool life from 75 to 25 minutes. He challenged the economics of the long-tool life theory. Now, two edges of a Kennametal* "throw-away" insert are used to machine a cylinder 72" long by 15½" diameter. But, he reports: "Two 21¢ cutting edges are an extremely small price to get high efficiency from a fine big machine."

Equipped with a Kendex* (Patented) KSBR-86 style tool holder with "throw-away" inserts, the lathe is turning 1040 steel with a 325 Brinell hardness. Now operating the lathe at 111 rpm, 430 sfpm, .027 feed, the company is satisfied that the increased tool cost, from 18¢ to 62¢ per hour, is insignificant because they have *tripled the output of a machine charged at $10 per hour.*

Ask your Kennametal Carbide Engineer how other companies are relieving the squeeze on profits by sacrificing pennies in tool life for top machine output. Ask him how your shop may get more work out of present machines at less cost. Or write KENNAMETAL INC., Latrobe, Pa., for the full story . . . ask for the booklet, "There's Profit in Retiring a Tradition."

*Trademark

CHECK THE SAVINGS POSSIBILITIES IN YOUR OPERATIONS

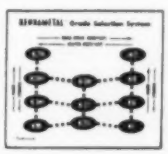
Jot down costs of throw-away inserts and output of one of your present machines . . . then in the next column the same data when insert life is reduced to 20, 30 or 40 minutes. The cost of inserts will multiply . . . but look what happens to over-all cost-per-piece and profit!

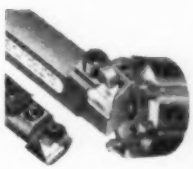
	Setup to get longest possible tool life	Full-capacity setup (for highest machine efficiency and output)
Machine cost per hour		
Tool cost per hour		
Total per 8-hour shift		
Pieces run per shift		
COST PER PIECE		

TO MULTIPLY YOUR MACHINE OUTPUT ...YOU NEED THREE THINGS:

1. The "Three-Man Tooling Team" that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . *to determine the right tooling.*

2. The Kennametal complete range of Grades that provides the precise properties and uniformity that *permits accurate prediction of tool life.*





3. Kendex* (patented) instant insert change without need to reposition the tool. This is the key to this new practice . . . *frequent tool change without excessive downtime.*

8760

Don't waste $$$ in machine output to save ¢¢¢ in longer tool life

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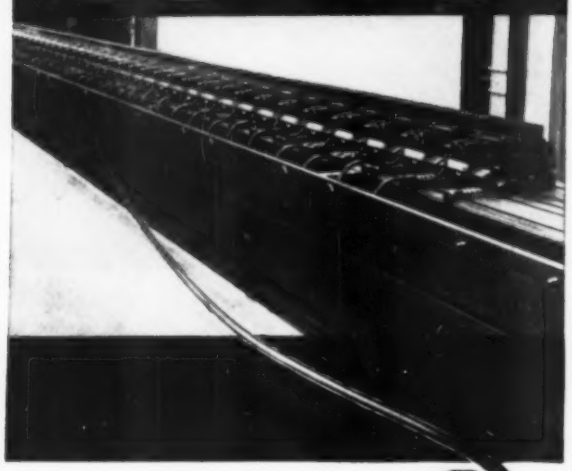

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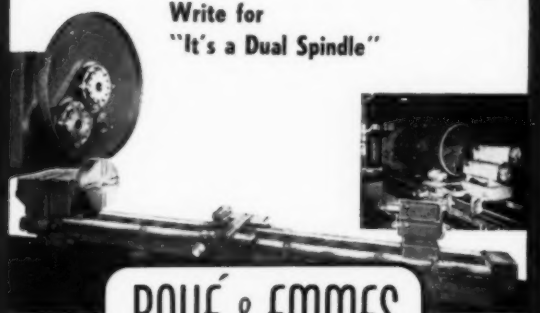

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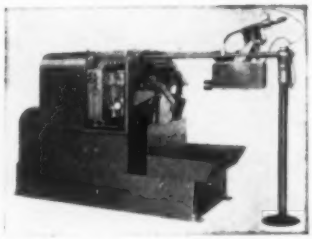

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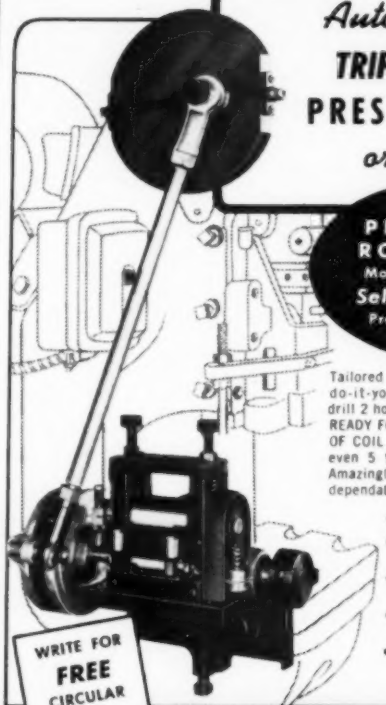

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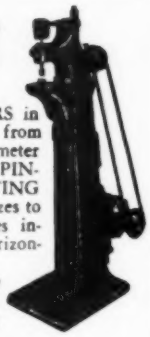

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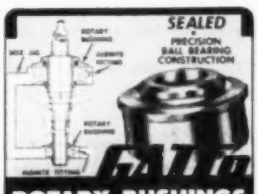

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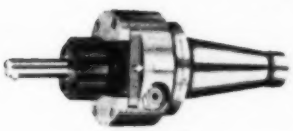

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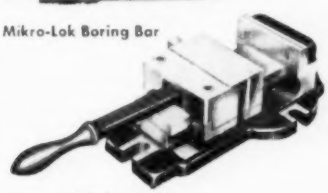

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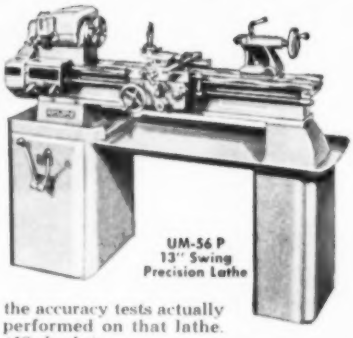

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Precision Lathe

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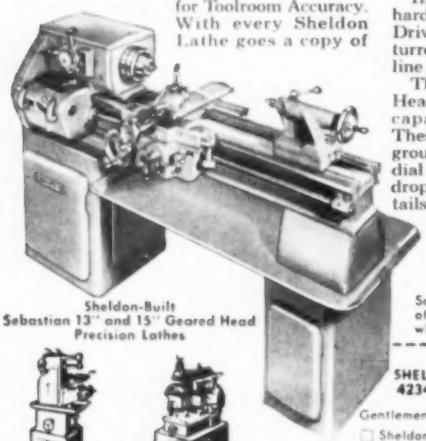

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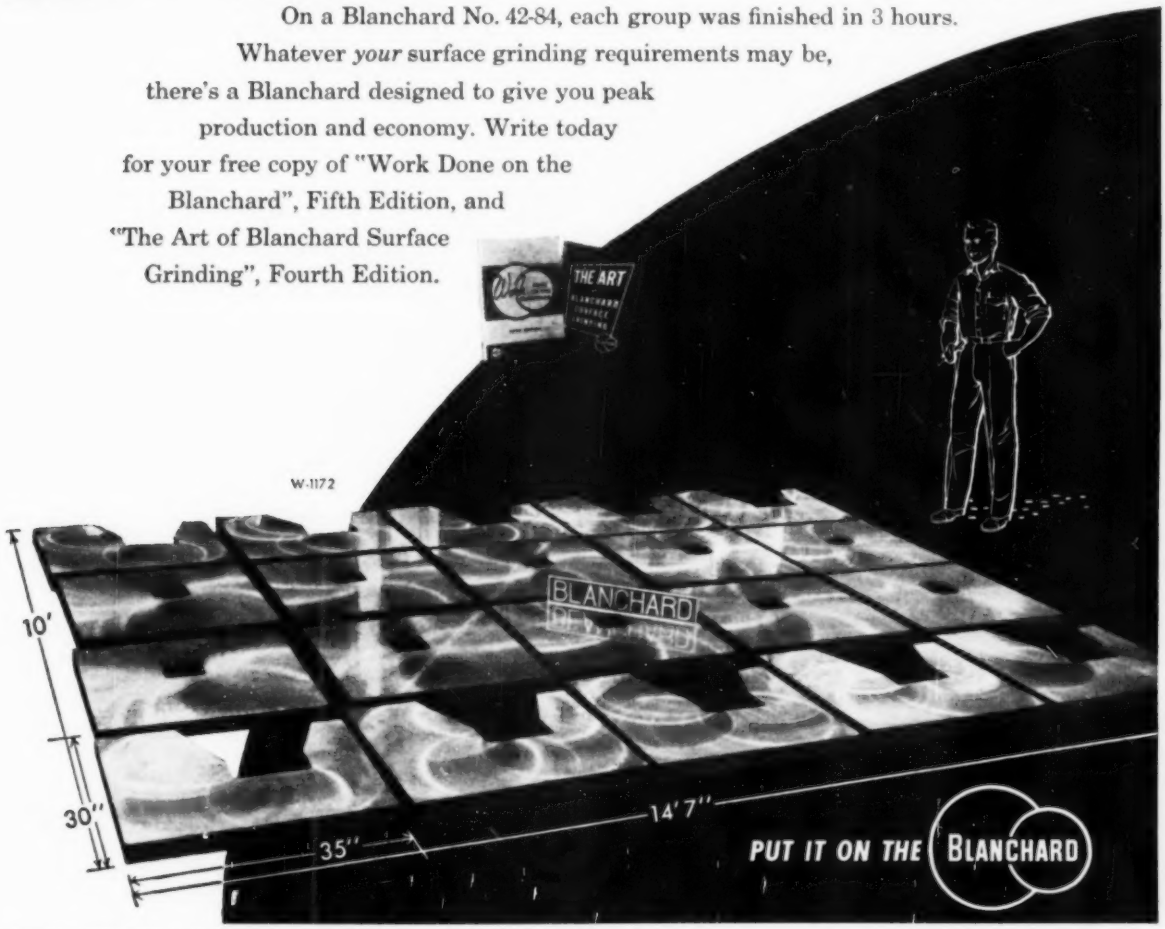

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2. Automatics
6. Boring Mills
7. Broaching Machines
16. Drilling & Reaming Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
41. Presses
50. Shapers
51. Shears

ADVERTISER	PAGE NO.	KEY TO PRODUCTS OR SERVICES
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Eastern Machinery Co.	222	24
Falk Machinery Co.	222	16, 24, 29, 33, 41
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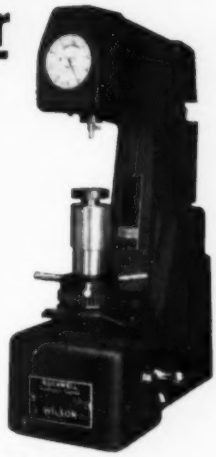
One of these Wilson "Rockwell" instruments will do your hardness testing job



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ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
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- *Eliminates* need for separate setups
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- *Assures uniform depth* of impressions on parts
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★ *Write TODAY for* 500-C brochure

SINCE 1931

NEW METHOD STEEL STAMPS, INC.
147 JOS. CAMPAU • DETROIT 7, MICHIGAN

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Many modern craftsmen practice the art of lapping and grinding with abrasive compounds. Clover sales prove it.

But we all need reminding, especially when new processes or products are being developed, that abrasive compounds often provide the most economical as well as the most accurate method of producing specified surfaces or shapes. Lapping or grinding with compounds offers many possibilities for tools and dies as well as for precision end-products. A check of available grains, vehicles, and methods before tooling up can be rewarding. Grains come in a full range of grit sizes, the viscosity of the vehicle is adapted to the required application, and the compound may be grease-mixed or water-soluble.

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Norwalk, Connecticut

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for profitable short run production . . .

the **STRIPPIT FABRICATOR**

WORK PIECE – Electronic Chassis — 10" x 14" — 23 holes — 5 sizes — 4 different shapes — 4 corner notches

SETUP TIME – 9.3 minutes

PRODUCTION RUN – 5 pieces

PRODUCTION TIME PER PIECE – 2.8 minutes

For short or pilot runs—model shop and experimental work—no other single machine can match the production capabilities and profit potential of the Strippit Fabricator.

PUNCHES—any round or shaped hole up to 3½" diameter in sheet material — up to ¼" mild steel.

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ACCURATE, QUICK-SET GAUGING—a unique, multiple-stop system permits exact positioning of the work to any layout specifications in seconds instead of minutes.

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WRITE TODAY—for Catalog 10 AA and an actual demonstration right at your own plant of the capabilities of this high-profit fabrication system, by a Strippit Mobile Demonstration Unit.

WALES STRIPPIT INC.

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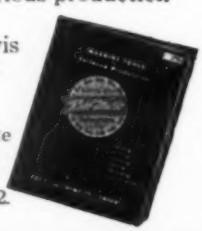
Double End Threading of 280 Shafts per hour

. . . with Davis & Thompson **Roto-Matic** *and Automatic Ejection*

Here's another example of Davis and Thompson Engineering of high production with a minimum of equipment. This GG-8 horizontal threader is equipped with 4 spindles in each head and a 4 station fixture. It is one of countless threading machines that have been designed and built by Davis & Thompson since 1924. Both single and double end machines for pipe, conduit, shafts and similar parts in various production quantities have been produced.
If you have work of this nature, call in a Davis & Thompson Representative. There is no obligation for this service.



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The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units so that repairs can be made easily.

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Makers of Dial Gages Since 1898

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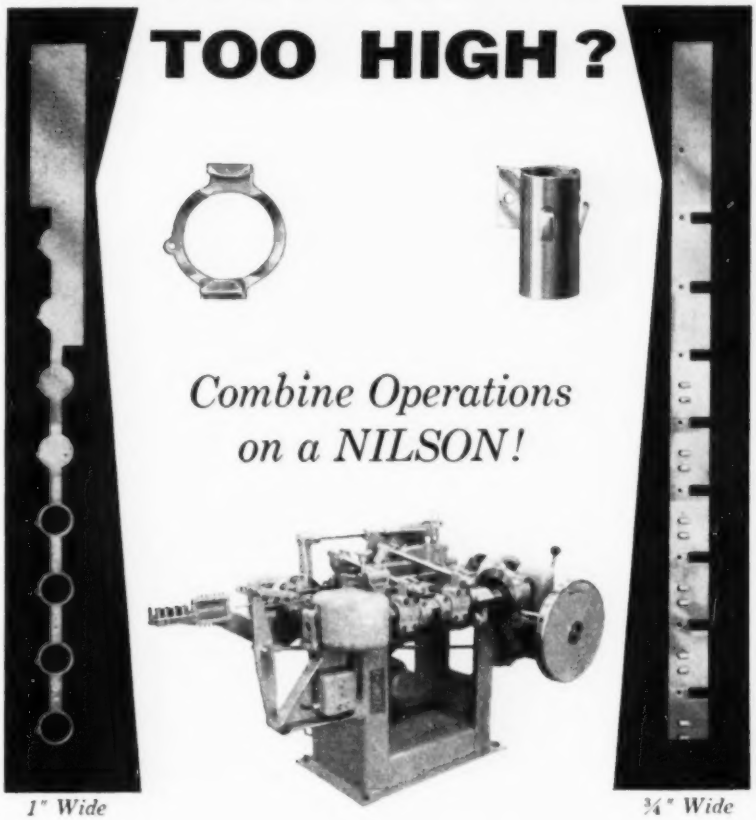
STAMPING COSTS TOO HIGH?



Combine Operations on a NILSON!

1" Wide *¾" Wide*

Stamping costs soar when additional operations must be performed. But a Nilson 4-Slide with built-in press combines stamping *and* forming into one automatic operation . . . no secondary handling . . . ensures product uniformity.

The electronic component shown at left is made of spring-tempered Phosphor bronze, .010" thick. Specifications called for .0002" tolerances on critical dimensions —and allowed a total cumulative error of only .001"!

Solution: A simple progressive die and ingenious 4-slide forming tools are producing this piece at the rate of two finished parts per second. Production costs are substantially lower than if tooled for a conventional press.

With *nine* standard working motions available on a Nilson 4-Slide, production performance is limited only by the ingenuity of the tool designer!

If you produce wire forms or small metal stampings, Nilson's 4-slide forming techniques can point the way to lower costs. Send prints or sample parts for engineering recommendations.

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment.

Parts & production data, courtesy of Plaza Tool & Die Corp., Long Island City, N.Y.

NILSON
THE A. H. NILSON MACHINE CO.
601 Bridgeport Avenue • Shelton, Conn.

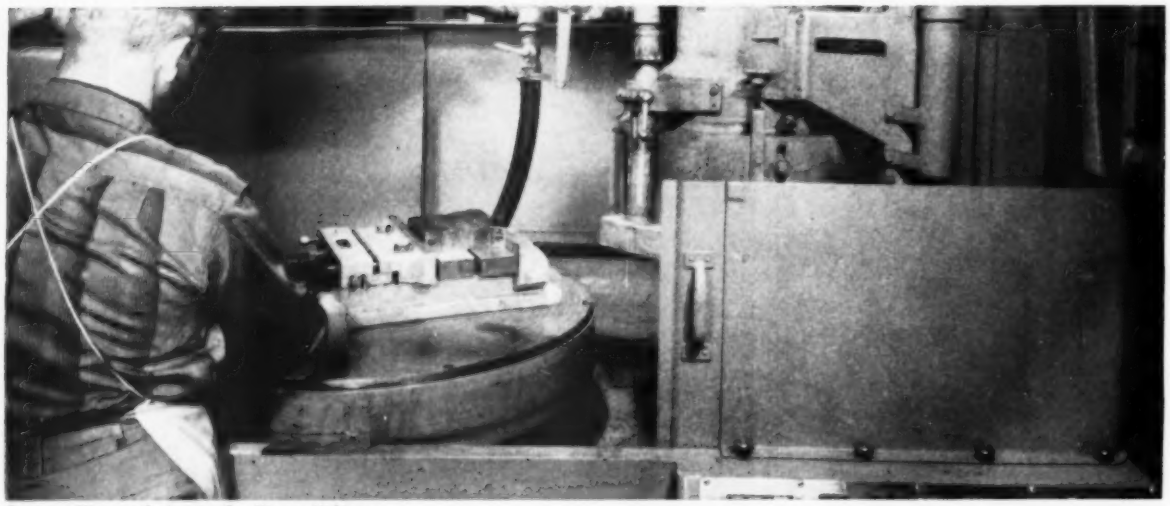
AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS

Fast, new grinding method replaces cutter-type machining

Betters production time by 75% . . removes up to ¼ in. stock per side . . . *economically*



Courtesy: Alignment Engineering Co., Warren, Michigan

Fig. 1—No. 24 vertical-spindle rotary pulls up to 60 hp through the spindle. Grinding mild steel, this rugged machine removes metal up to three times faster than conventional surface grinders. With this in mind, many plants (like this one) are buying them as a stock-removal tool.

Three shapers replaced . . . machining time cut from 6 to 1½ hr. . . . up to ¼ in. stock removal per side economical with new method . . .

These are results from a Michigan company (typical jobs shown) after installation of a Mattison No. 24 vertical-spindle surface grinder with Quick-Tilt spindle. Such performance proves that a rigid, high-powered vertical is now . . . more than ever . . . a stock-removal machine as well as a precision grinder.

Two machines for the price of one

Until the introduction of the Quick-Tilt spindle rotary late last year, grinding dead flat parts on a production basis meant you had to accept one of two types of inefficiency: (1) excessive downtime for changing one machine from a rougher to a finisher . . . or (2) "two-timing"—keeping two grinders set up for successive roughing and finishing.

Now, a flick of the switch tilts the spindle for rough and finish operations in a single setup, without even stopping the machine. In effect, this gives you two machines for the price of one. But, that's only part of the story.

The Quick-Tilt rotary does more than provide a dual cycle on one grinder. It combines high horsepower (60 on the No. 24—100 on the No. 36) and rugged construction, with the best features available for precision, fine-finish work.

Fig. 2—Quick-Tilt improves accuracy, too. Parts requiring extremely close tolerances can be ground faster, utilizing full table capacity.

Hidden savings a big factor

Another reason why it pays to own a new Mattison is reduction of hidden costs. You can reduce your stock allowances for grinding and eliminate cutter-type machining of flat surfaces. With self-dressing wheels, machine downtime for changing the cutting tool and cost of re-sharpening can be eliminated. This is important because actual machining time on a surface grinder is often less than on a machine that produces much bigger chips. Improved finish and accuracy are a bonus. And don't forget—hard spots, burned edges, and tough outer scale are no problem for a grinding wheel.

To the grinding man all these advantages add up to *maximum versatility in a standard machine.*

Ask for a test grind

We don't expect you to rush through a purchase order for a new grinder on the strength of this ad. But, if it seems to make sense in terms of your particular machining problems and costs, we do hope you'll investigate further. Send us your piece-parts for a sample grind in the Mattison Methods Lab. There's no cost (other than shipping expense) for a complete report covering stock removal, wheel life, production rate, wheel specs, surface finish, accuracy, etc. Your Mattison dealer will make all the arrangements—or, phone the factory direct.

MATTISON MACHINE WORKS
Rockford, Illinois • WOodland 2-5521

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4	26	48	70	92	114	136	158	180	202	224	246	268	290	312	334	356	378	400	422	444
5	27	49	71	93	115	137	159	181	203	225	247	269	291	313	335	357	379	401	423	445
6	28	50	72	94	116	138	160	182	204	226	248	270	292	314	336	358	380	402	424	446
7	29	51	73	95	117	139	161	183	205	227	249	271	293	315	337	359	381	403	425	447
8	30	52	74	96	118	140	162	184	206	228	250	272	294	316	338	360	382	404	426	448
9	31	53	75	97	119	141	163	185	207	229	251	273	295	317	339	361	383	405	427	449
10	32	54	76	98	120	142	164	186	208	230	252	274	296	318	340	362	384	406	428	450
11	33	55	77	99	121	143	165	187	209	231	253	275	297	319	341	363	385	407	429	451
12	34	56	78	100	122	144	166	188	210	232	254	276	298	320	342	364	386	408	430	452
13	35	57	79	101	123	145	167	189	211	233	255	277	299	321	343	365	387	409	431	453
14	36	58	80	102	124	146	168	190	212	234	256	278	300	322	344	366	388	410	432	454
15	37	59	81	103	125	147	169	191	213	235	257	279	301	323	345	367	389	411	433	455
16	38	60	82	104	126	148	170	192	214	236	258	280	302	324	346	368	390	412	434	456
17	39	61	83	105	127	149	171	193	215	237	259	281	303	325	347	369	391	413	435	457
18	40	62	84	106	128	150	172	194	216	238	260	282	304	326	348	370	392	414	436	458
19	41	63	85	107	129	151	173	195	217	239	261	283	305	327	349	371	393	415	437	459
20	42	64	86	108	130	152	174	196	218	240	262	284	306	328	350	372	394	416	438	460
21	43	65	87	109	131	153	175	197	219	241	263	285	307	329	351	373	395	417	439	461
22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396	418	440	462

INSIDE FRONT COVER — INSIDE BACK COVER — BACK COVER

UNKEYED AD

Name_____

Title_____

Company Name_____

Address_____

City, State_____

SEARCHLIGHT SECTION

Surplus	Used and Rebuilt Equipment	
500	507	514	521	528
501	508	515	522	529
502	509	516	523	530
503	510	517	524	531
504	511	518	525	532
505	512	519	526	533
506	513	520	527	534

more data?

it's easy

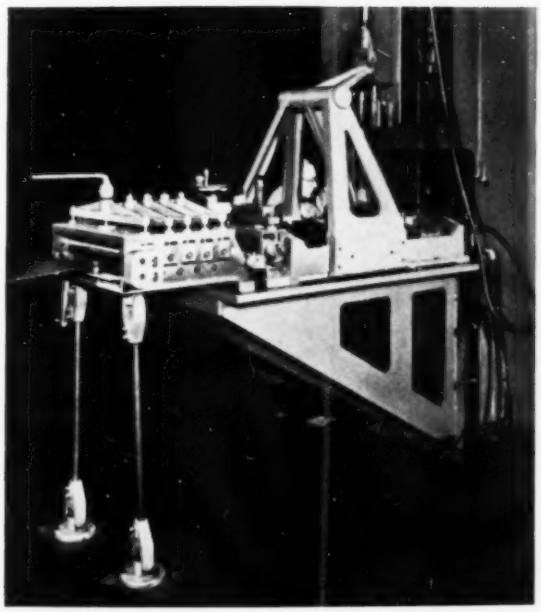
1. Circle Key Number(s)
on these cards that
correspond(s) to number(s)
at bottom of advertisement(s),
new equipment item(s)
or catalog(s) offered

2. Print clearly . . .
name, title, company name and address

3. Tear Off and Mail . . .
We'll do the rest

Use these time-saving cards to keep up-to-date with the metalworking industry

TEAMED FOR PRESS ROOM EFFICIENCY



SF-2424 U. S. Slide Feed with an SS-24-8 Plain Straightener, mounted on a straight side press to feed from left to right. This combination is capable of handling stock up to 24" wide — maximum length of feed is 24".

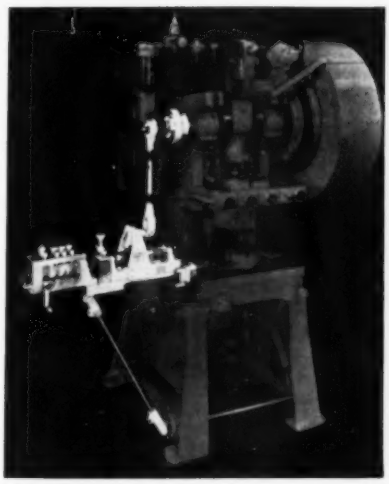
U. S. Automatic Press Room Equipment is made to team perfectly with your present presses. All units are engineered and built solely to increase the efficiency of your presses — to bring you the savings which result from the use of coil stock.

U. S. mechanical driven Slide Feeds have long been recognized by users as the most accurate automatic feeds on the market. They are built in a range of sizes with width capacities from 1½" up to 27", and all sizes can be teamed with matched Plain Stock Straighteners.

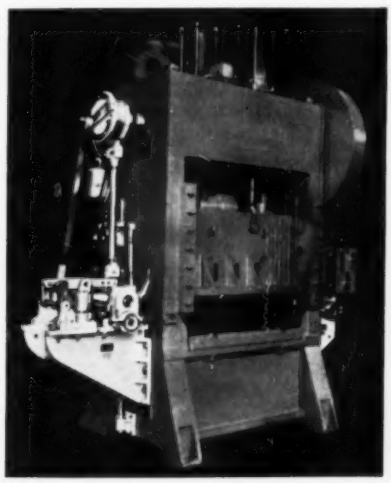
Where wire of round or irregular cross-section is to be fed, U. S. Slide Feeds are supplied with Two-way Wire Straighteners.

For certain applications, where roll feeding is desirable, U. S. Roll Feeds are available in either single or double types.

Whether you are working with .020" wire or wide flat stock, when you have U. S. equipment you have the perfect team for both short and long run jobs.



Model SF-1 U. S. Slide Feed with matching Plain Straightener, for stock widths up to 2½" — maximum length of feed 4".



Model RF-1212 U. S. Double Roll Feed (Racks and Pinion Type). Capacity: for material up to 12" in width, feed length adjustable up to 12".

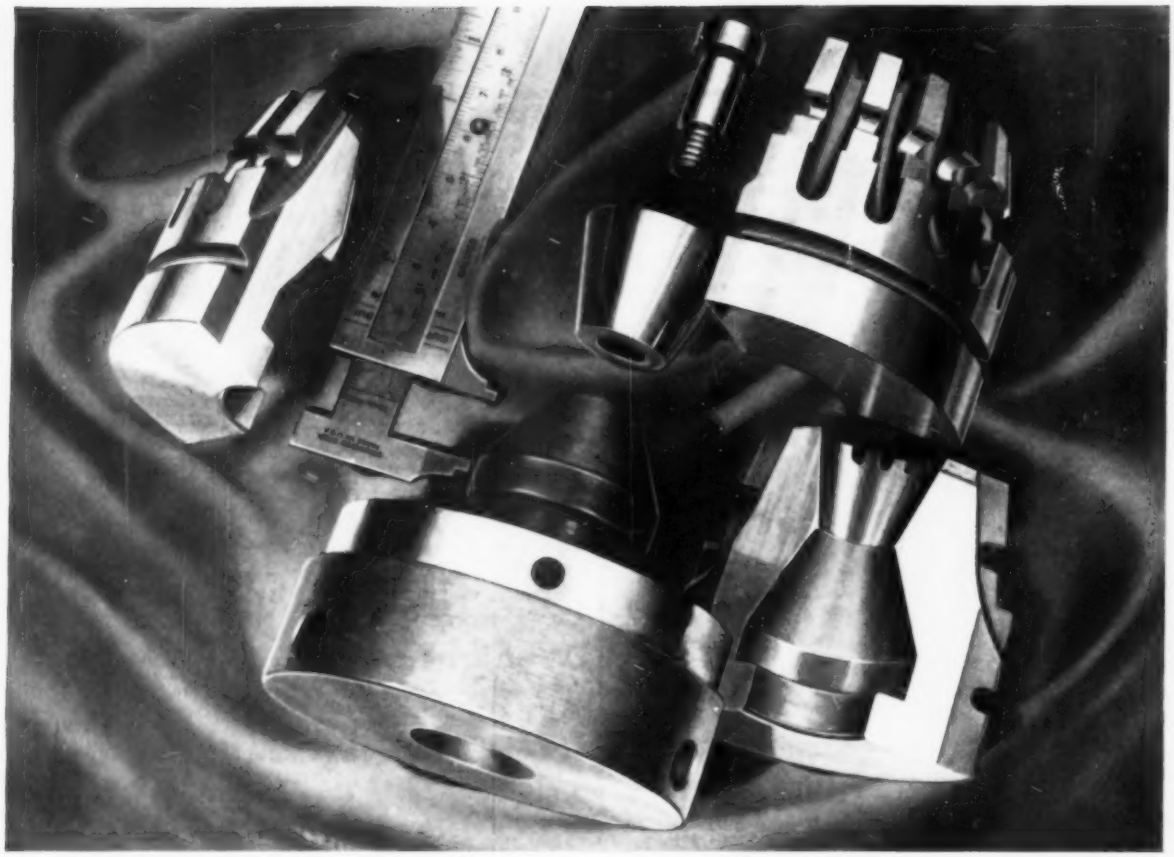
US PRODUCTS

Slide Feeds
Roll Feeds
Stock Straighteners
Stock Reels
Stock Oilers
Coil Cradles
Die Sets
Multi-Slides®
Multi-Millers®
Wire Straighteners
Combination Cradle Straighteners
Combination Reel Straighteners

Complete information about U. S. Automatic Press Room Equipment is yours by asking for Bulletin No. 85A.

U. S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY



INTRICATE SHAPES MADE EASY WITH GRAPH-AIR®

hardens at 200° to 300° lower than most air-hardening tool steels

YOU can make intricate shapes like these easier and at less cost with versatile Graph-Air tool steel. Here's why:

1) **GRAPH-AIR AIR-HARDENS FROM AS LOW AS 1450°F.** That's as much as 400 degrees lower than most air-hardening tool steels. You reduce distortion, simplify heat treating control, minimize scaling and decarburization.

2) **GRAPH-AIR MACHINES FASTER.** The free graphite in its structure makes it machine 30% faster than ordinary tool steels. Means more production for you.

3) **GRAPH-AIR HAS MORE STABILITY.** It's one of the Timken Company's graphitic tool steels, the most stable tool steels ever made. Tests prove it. And that means longer accuracy for parts made of Graph-Air.

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1. Quality that's uniform from heat to heat, bar to bar, order to order
2. Service from the experts in specialty steels
3. Over 40 years experience in solving tough steel problems

TIMKEN® *Fine Alloy* STEEL

TIMKEN GRAPHITIC STEELS ARE CARRIED IN STOCK BY 9 DISTRIBUTORS WITH 42 WAREHOUSES IN 31 CITIES IN THE UNITED STATES AND CANADA